

FEDERAL OCEAN PROGRAMS REVIEW

HEARINGS
BEFORE THE
SUBCOMMITTEE ON OCEANOGRAPHY
OF THE
COMMITTEE ON
MERCHANT MARINE AND FISHERIES
HOUSE OF REPRESENTATIVES
NINETY-THIRD CONGRESS
SECOND SESSION
ON
THE VARIOUS ASPECTS OF THE FEDERAL OCEAN PRO-
GRAMS AND THE INTERAGENCY COORDINATION OF
OCEAN ACTIVITIES

MARCH 28, 29, APRIL 11, 1974

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FEDERAL OCEAN PROGRAMS REVIEW

TUESDAY, MARCH 26, 1974

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met, at 10:20 a.m., in room 1334, Longworth Office Building, Hon. Thomas N. Downing (chairman of the subcommittee) presiding.

Mr. DOWNING. The subcommittee will come to order.

The subcommittee on Oceanography is meeting today to begin a series of hearings to consider the various aspects of what has been called, euphemistically, the Federal ocean program. While there has indeed been significant improvements in the interagency coordination of ocean activities, I question whether we have, in fact, reached the point of describing those activities as a single ocean program.

Today, in the first of these hearings, the subcommittee is privileged to hear from the National Advisory Committee on Oceans and Atmosphere, which, under its legislative charter, is required to undertake a continuing review of the progress of the marine and atmospheric science and service programs of the United States, and to submit a comprehensive annual report setting forth an overall assessment of the status of the Nation's marine and atmospheric activities.

The advisory committee was established by Public Law 92-125 in August 1971, and was organized and began its work in early 1972. It submitted its first annual report on June 30, 1972, and this subcommittee discussed that report with the chairman and members of his advisory committee later that fall.

The second annual report of NACOA, which will be discussed today, was completed on June 29, 1973, and submitted to the Congress in August 1973. Unfortunately, the subcommittee was unable to make arrangements to discuss that report with the advisory committee prior to the end of the first session of the present Congress.

Because the latest developments in relation to ocean programs have drawn more and more recent attention to ocean uses and ocean resources, not only because of the progress toward a Law of the Sea Conference, but also because of the energy crisis which has just faced us, it appeared desirable to me for the subcommittee to address itself in some detail to all aspects of marine science activities and to the relationships of the various departments and agencies which have not received careful legislative review in the past few years.

Since January 1969, when the so-called Stratton commission made its report to the Congress, several pieces of legislation and several

administrative initiatives have occurred. One of the first of these was the establishment in 1970 of the National Oceanic and Atmospheric Administration as an agency in the Department of Commerce. The second was the establishment of the National Advisory Committee on Oceans and Atmosphere in 1971. The third was the enactment of the Coastal Zone Management Act of 1972. All three of these were specific outgrowths of the Stratton commission report.

The question now as I see it is whether there has been adequate advancement, looking toward a focus on ocean problems. I hope that this series of hearings will answer that question.

At this time I ask unanimous consent for insertion in the record of the NACOA enabling legislation and copies of both the first and second annual reports from NACOA, together with the comments of the Secretary of Commerce on each report.

[The legislation and reports referred to follow:]



Public Law 92-125
92nd Congress, H. R. 2587
August 16, 1971

An Act

85 STAT. 344

To establish the National Advisory Committee on the Oceans and Atmosphere.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, There is hereby established a committee of twenty-five members to be known as the National Advisory Committee on Oceans and Atmosphere (hereafter referred to in this Act as the "Advisory Committee").

National Advisory
Committee on
Oceans and
Atmosphere,
Establishment.

SEC. 2. (a) The members of the Advisory Committee, who may not be full-time officers or employees of the United States, shall be appointed by the President and shall be drawn from State and local government, industry, science, and other appropriate areas.

(b) Except as provided in subsections (c) and (d), members shall be appointed for terms of three years.

(c) Of the members first appointed, as designated by the President at the time of appointment—

- (1) nine shall be appointed for a term of one year,
- (2) eight shall be appointed for a term of two years, and
- (3) eight shall be appointed for a term of three years.

(d) Any member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed only for the remainder of such term. A member may serve after the expiration of his term until his successor has taken office.

(e) The President shall designate one of the members of the Advisory Committee as the Chairman and one of the members as the Vice Chairman. The Vice Chairman shall act as Chairman in the absence or incapacity of, or in the event of a vacancy in the office of, the Chairman.

Chairman and
Vice Chairman

Sec. 3. Each department and agency of the Federal Government concerned with marine and atmospheric matters shall designate a senior policy official to participate as observer in the work of the Advisory Committee and to offer necessary assistance.

Sec. 4. The Advisory Committee shall (1) undertake a continuing review of the progress of the marine and atmospheric science and service programs of the United States, and (2) advise the Secretary of Commerce with respect to the carrying out of the purposes of the National Oceanic and Atmospheric Administration. The Advisory Committee shall submit a comprehensive annual report to the President and to the Congress setting forth an overall assessment of the status of the Nation's marine and atmospheric activities and shall submit such other reports as may from time to time be requested by the President. Each such report shall be submitted to the Secretary of Commerce who shall, within 90 days after receipt thereof, transmit copies to the President and to the Congress, with his comments and recommendations. The comprehensive annual report required herein shall be submitted on or before June 30 of each year, beginning June 30, 1972.

Sec. 5. Members of the Advisory Committee shall, while serving on business of the Committee, be entitled to receive compensation at rates not to exceed \$100 per diem, including traveltime, and while so serving away from their homes or regular places of business they may be allowed travel expenses, including per diem in lieu of subsistence, in the same manner as the expenses authorized by section 5703(b) of title 5, United States Code, for persons in Government service employed intermittently.

Sec. 6. The Secretary of Commerce shall make available to the Advisory Committee such staff, information, personnel and administrative services and assistance as it may reasonably require to carry out its activities. The Advisory Committee is authorized to request from any department, agency, or independent instrumentality of the Federal Government any information and assistance it deems necessary to carry out its functions under this Act; and each such department, agency, and instrumentality is authorized to cooperate with the Advisory Committee and, to the extent permitted by law, to furnish such information and assistance to the Advisory Committee upon request made by its Chairman, without reimbursement for such services and assistance.

Sec. 7. There is hereby authorized to be appropriated to the Secretary of Commerce \$200,000 for the fiscal year ending June 30, 1972, and each succeeding fiscal year to carry out the purposes of this Act.

Approved August 16, 1971.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 92-201 (Comm. on Merchant Marine and Fisheries).

SENATE REPORT No. 92-333 (Comm. on Commerce).

CONGRESSIONAL RECORD, Vol. 117 (1971):

May 17, considered and passed House.

Aug. 2, considered and passed Senate, amended.

Aug. 5, House concurred in Senate amendments.



Public Law 92-567
92nd Congress, H. R. 15280
October 25, 1972

An Act

86 STAT. 1181

To amend the Act of August 16, 1971, which established the National Advisory Committee on Oceans and Atmosphere, to increase the appropriation authorization thereunder.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 7 of the Act of August 16, 1971 (Public Law 92-125; 85 Stat. 344), is amended to read as follows: "There are hereby authorized to be appropriated to the Secretary of Commerce, for the fiscal year ending June 30, 1973, and for each of the two fiscal years immediately thereafter, such sums, not to exceed \$100,000, as may be necessary for expenses incident to the administration of this Act, and for succeeding fiscal years only such sums as may be authorized by law."

National Advisory Committee on Oceans and Atmosphere. Appropriation authorization, increase.
33 USC 857-12.

Approved October 25, 1972.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 92-1467 (Comm. on Merchant Marine and Fisheries), CONGRESSIONAL RECORD, Vol. 118 (1972):

Oct. 11, considered and passed House.

Oct. 13, considered and passed Senate.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS, Vol. 8, No. 44:

Oct. 28, Presidential statement.

A Report to:

The President
and
The Congress

by the
National
Advisory
Committee on
Oceans and
Atmosphere

First Annual Report June 30, 1972

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**NATIONAL ADVISORY COMMITTEE
ON
OCEANS AND ATMOSPHERE**
Washington, D.C. 20230

To the President and the Congress:

Sirs:

I have the honor to submit to you the first Annual Report of the National Advisory Committee on Oceans and Atmosphere.

The Committee was established by P.L. 92-125, approved on August 16, 1971, and was directed to submit a comprehensive annual report to the President and to the Congress setting forth an overall assessment of the status of the Nation's marine and atmospheric activities.

This report is submitted to the Secretary of Commerce for transmittal as provided by the statute.

Respectfully,


William A. Nierenberg
Chairman

June 30, 1972

FOREWORD

The newly formed National Advisory Committee on Oceans and Atmosphere (NACOA) has been charged by P.L. 92-125 to have direct concern with both the oceans and the atmosphere. NACOA is advisory to both the President and the Congress on the Nation's marine and atmospheric affairs—and to the Secretary of Commerce with respect to the National Oceanic and Atmospheric Administration.

To review and evaluate every program and issue over the vast domain of NACOA responsibility is to treat none of them well and would mean attempting, in some instances, to do what others are capable of doing better.* But to be able to

* In this, NACOA's first year, we have naturally drawn heavily on a long series of reports by which the field, particularly of oceanography, has been enriched. Specifically we wish to acknowledge our indebtedness to: "Oceanography 1960-1970," National Academy of Sciences, Committee on Oceanography, 1959. "Oceanography, the Ten Years Ahead, a Long-Range Oceanographic Plan 1963-1972," Interagency Committee on Oceanography of the FCST, ICO Pamphlet No. 10, June 1963. "Effective Use of the Sea," Report of the Panel on Oceanography, President's Scientific Advisory Committee, June 1966. "Our Nation and the Sea, A Plan for National Action," Report of the Commission on Marine Science, Engineering and Resources (Stratton Commission), January 1969. The five Annual Reports on Marine Science Affairs by the National Council on Marine Sciences and Engineering Development, 1967 through 1971, inclusive.

select for priority attention those maritime and atmospheric issues that have become urgent, whether for economic, social, or technological reasons, is an opportunity afforded no existing committee in this area. This opportunity NACOA has been given by its charter and by its statutory permanence. We find it a sobering charge.

In NACOA's First Annual Report to the President and to the Congress, we have chosen four topics: Law of the Sea, Fisheries, Weather Modification, and Coastal Zone Management. These issues meet two criteria: each is of current importance and each, despite the short half-year of our existence, we feel we can treat with balance. This means that some issues we did not treat may be more important than some we did, but we did not feel we can be helpful in these particular areas with so short a time to prepare. However, what we lay aside this year we may be in position to consider next. It also means that we judge some areas neglected in this Report to be well in hand. This is particularly true of the national program in basic marine and atmospheric research despite certain weaknesses in ocean engineering.

Of all the fundamental and pressing issues which NACOA wanted to include in this Report, but did not, Marine Transportation stands out. We did agree that recent governmental actions have been important in slowing the decline in our merchant marine. However, we also found that

it was next to impossible to examine the issues and choices from an adequate perspective in the absence of a detailed analysis of the maritime transportation system as it inter-relates with problems of economic growth, social costs and benefits, and environmental goals. *We recommend that the Secretary of Commerce be asked to undertake such a study in consultation with NACOA.* Such a study would be a major undertaking that could reveal a much greater possible contribution to our Nation's overall well being than even the present ardent supporters of a merchant marine consider to be the case.

It is NACOA's intent to learn how best to be of service to those we advise. It is our hope to place major issues in the context of national interest to reflect our understanding of the interplay between science, technology, and social and economic factors in national policy decisions in the light of limitations of manpower, budgetary, and physical resources. It is NACOA's goal to help clarify what is good husbandry of the resources of the sea and air and what this can mean to the United States of America.

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Introduction

A similarity which runs through most of the issues in NACOA's First Annual Report is the underlying need for specific international understandings as a requisite for solution. This requirement stems less from the international nature of the oceans and the atmosphere than it does from the need for wise management of what have lately become recognized as limited resources.

Effective resource management requires agreement among the parties whose interests are involved; interdependence amongst nations therefore clearly complicates matters. While coincidence between national and international interests plainly exists, it has nevertheless grown more difficult in recent years to keep questions of international politics from taking over where technological interchange would better serve all concerned. The hope is that where there is growing international awareness of a common problem, there can be found the mechanisms for providing the technological inputs for working things out.

Common interest issues are prominent in three of the four sections of this Report. In "Some International Issues Related to Law of the Sea" they are central. Here NACOA reviews the developing controversies over freedom of passage, freedom for research, and the jurisdiction of fisheries, and proposes means for fostering their resolution while protecting U.S. interests. In a second section, NACOA notes the growing international awareness that fish can be harvested to extinction if not biologically managed and suggests how this awareness provides the opportunity to work at rehabilitating the U.S. fisheries.

Thirdly, recognizing advances in the ability of some developed nations, including our own, to modify the weather both intentionally and inadvertently, NACOA advocates intensified national and international discussion and development of appropriate regulation.

The fourth section of the Report, on coastal zone management, though specific to the United States, describes a situation demanding virtually

unprecedented management efforts to weave together and rationalize the conflicting and at times incompatible needs of the many different users of this resource. The coastal zone is not only complex naturally, it is also the focus for an unusual confluence of national, regional, state, and local interests. Which is David and which Goliath when it comes to the oil terminal or the bathing beach? the oyster or the dredge? Here again NACOA finds that the nation's science and technology can be more effectively used in support of management. It is on the means for promoting a more effective interaction between management and science that the discussion of the coastal zone centers.

Finally, in a brief section titled "Moving Ahead" NACOA emphasizes the urgent need for action and for facing up to the pervasive impact on our society that appropriate action will have. The alternative, doing nothing, is in our view unthinkable. The days of the open ocean and limitless air are gone. The oceans and the atmosphere belong to all rather than to none, and it is in our common interest to enhance the use and decrease the abuse to which they are made subject.

Some International Issues Related to Law of the Sea

The rules governing the use of the seas by the nations of the world are today in a transition comparable to that which took place in our own country when the frontier and the open range disappeared. While NACOA finds the emerging U.S. positions at the level of the Working Group on Law of the Sea soundly in the national interest and consistent with international needs, it also finds that the actual situation, and the U.S. current tactics in negotiation, give less cause for optimism. These matters are discussed with respect to freedom of passage, fisheries, and freedom of research. NACOA then suggests the kind of effort and program adjustment which should result in a more positive approach and improved prospects for international agreement.

It will be impossible to come anywhere near the oceanic goals set by the Congress or proposed by earlier commissions and councils until an updated and accepted set of international rules is developed for international oceanic operations. The international negotiations on the Law of the Sea have a status comparable to those on disarmament, and may very well take longer to resolve. We should take care not to view this matter with undue optimism in view of the complexity and wide range of issues to be resolved.

The basic issues before us are in several broad categories which have to do with:

- the extent of territorial waters and the resultant effect on freedom of navigation and overflight and freedom for research;
- fisheries; and
- the appropriate regime for the management of the ocean basins.

The complexity of the issues derives from the many different interests, national and international, and has diplomatic aspects that are normally not discussed in official reports. NACOA nevertheless feels that the importance of a full and frank discussion of this multifaceted problem is essential if procedures and programs are to be adopted that can move matters forward. We conclude that the present situation is unsatisfactory

internationally and that the current U.S. procedures will not suffice to achieve the U.S. policy goals. This is a pessimistic statement more with respect to the direction matters have taken internationally than to specific criticism of past approaches. Nevertheless, NACOA feels that these difficulties could have been sooner anticipated and a more imaginative and coordinated program could have been developed.

NACOA has been critical of the activities of the Working Group on the Law of the Sea because of an apparent diffusion of objectives and a lack of sharply developed policies or positions. The situation has recently improved considerably, undoubtedly through the effect of increasing the delegation by five nongovernmental experts, and the formation of a broadly based advisory committee. One of the results of this interaction is, as is noted later, an agreed industrywide position for the fisheries industries. There is, however, the ever-present danger of weakening of objectives under the grind and tedium of a one-hundred nation debate.

The entire position of the United States in international oceanic affairs should be thoroughly reviewed and clarified without neglecting the possible contribution of any department or agency. The position must include a strong policy for keeping the oceans and the classical straits open for free navigation and the oceans free for commerce and for responsible scientific research. The oceans are a common heritage. This heritage carries with it the necessity for freedom to explore, freedom for navigation, and freedom for simple human enjoyment.

ACHIEVEMENT AT GENEVA (1958)

With these goals in mind, and before setting down specific programmatic recommendations, we present our analysis of the current situation and the history of how we arrived at what appears to NACOA to be a difficult impasse. Perhaps the most useful and illuminating starting point is the Geneva Conventions of 1958. These Conventions were the result of intensive and arduous preparatory conferences. They were momentous achievements, made possible largely by intensive and lengthy preparations involving considerable technical consultation. The signatories assigned the bottom resources out to the 200-meter depth to the adjacent state and made easy allowance for general research outside of territorial waters in this zone by agreeing that permission to carry on research in this region would "not normally be withheld." Freedom for research in the ocean basins outside these limits was unrestricted. Considerable detail went along with these conventions—specifying, for example, that lobster and shrimp were not to be classified as belonging to the bottom but rather to the water mass, and so on.

One provision was accepted that may soon be a thorny issue; it provided that the bottom resources of the region beyond the 200-meter depth be assigned to the adjacent state to the extent that they are economically

exploitable. Until recently it was expected that this controversial clause would be a dominant issue in the current discussions. Then a host of other difficulties arose which seemed for a while to overshadow it: concern about the depletion and management of the living resources of the world ocean, proposals for ultimate arrangements for the exploitation of the ocean basins, a number of unilateral extensions of territorial limits, a deepening universal concern about the environmental degradation of the oceans, and concerns dealing with the destruction of species, such as the whale. However, growing oil consumption may again force to the fore problems having to do with resources beneath the ocean floor.*

APPROACH TO GENEVA (1973)

Against this background we wish to make four observations. The first is that treaties in matters of this kind where a common heritage is involved must allow for change. In the course of increasing knowledge of the oceans and their resources, and increasing threats to the oceans, it is clearly necessary to review the arrangements periodically and adjust them equitably to new needs based on new knowledge. This point applies principally to our present emergent fisheries position.

The second observation is that these conventions have the force of international law and should be observed as such. Unfortunately U.S. experience with the 1958 Geneva Conventions has been largely the opposite. This experience raises grave questions as to the usefulness of attempts to improve the situation by treaty revision alone, unless a better basis is laid. For example, in waters off Chile, Peru, Ecuador, and Brazil, the United States or its fishermen have had to pay fines or seek permits in areas in which there should be unrestricted fishing access under generally accepted provisions and conditions at the time of the 1958 Conventions. Another example is in the area of scientific research. Various countries have affected the freedom to conduct scientific research in that they have not routinely granted permission to perform research in waters over their shelves, or they have instituted permission-granting procedures sufficiently cumbersome in many instances as to effectively exclude certain areas from planning for scientific research cruises. Their reasons often seem obscure, but it appears that they may be interpreted as possible efforts to force the reopening of previously settled matters for the impending Law of the Sea negotiations. It is all the more discouraging to observe that, for other reasons, several of the developed nations have also denied permission for

* It is possible that there will be a considerable lapse of time before international agreement on Law of the Sea is attained. NACOA recognizes that economic and other pressures may develop to such an extent that individual nations including the United States will take unilateral actions, especially with respect to resource exploitation. NACOA therefore urges consideration by the U.S. Government of suitable interim arrangements that will allow development of these resources to proceed, but at the same time will offer reasonable probability of meshing with eventual international agreements.

research on their shelves. The reasons may well have involved serious national questions, but they have also had chauvinistic overtones.

This leads to a third observation, our pessimism as to the chaotic state and the ultimate benefit of the preparatory sessions leading to the 1973 Law of the Sea Conference. The difference between the 1958 Conference, with its mark of success, and the current negotiations is that the former was preceded by quiet and hard work on the part of technical experts. The 1958 results were based on the best oceanic expertise available at the time and were limited to a small number of priority issues. Despite the best efforts of the United States and other major powers to limit the forthcoming Conference to a few issues—particularly the question of territorial limits—the member nations, led by the lesser developed countries, overwhelmingly voted to include all issues on the agenda. Most of the countries will not have the time to become adequately informed technically on a broad array of complex issues. Thus the Conference may degenerate into a series of position-taking statements on very narrow local issues rather than a striving for an optimum regime for the benefit of all and for a situation that could enhance conflict-free prospects around the world.

Our fourth observation is that a legalistic approach will not serve and an alternative must be sought. A legalistic approach will only work to maintain the present fractionated situation. A strongly pragmatic approach based on the realities of what the oceans can offer mankind and what is needed to deliver on this offer allows more hope for success. It appears that the true requirement is a framework which permits all nations to jointly participate in a mutual educational effort centered on the world's oceans, the current and future resources, and the factors to be balanced if mankind's long-term needs are to be most appropriately met by oceanic means.

Today's strong movement in the direction of further nationalism carries with it serious threats to classical free movement on the oceans. This is contradictory to the lofty phrase, the "common heritage of mankind," which opened the present debates on the uses of the resources of the midocean.

The current position of the United States with respect to three important issues treated in this chapter (freedom of passage, fisheries, and freedom of research) as it has slowly evolved in the ferment of the last years, seems to us now eminently sound. It satisfies U.S. national interests, it is based on good conservation principles, and it seems the best arrangement leading to an amicable international situation and the common good.

The Issue of Free Passage

The U.S. policy for free passage in waters outside the 12-mile territorial limit and in classical straits must remain unmodified. It is required in the

interests of world trade and communication, and is necessary to prevent cumbersome restrictions or procedures being placed in the way of open research. It is also necessary with respect to national defense. In this regard, the Committee has in mind not only the classical requirement for defense systems but also the historical fact that restrictions imposed on classical straits passage have almost always converted them to foci of military confrontation and sources of conflict.

The Issues of Fisheries

The U.S. position with respect to the fisheries question has been slow in formulation because of the lack of an agreed industrywide position. Now, however, the industry as a whole has agreed to support the position prepared by the U.S. Working Group. The coalition of interest has been largely induced by the realization that the current worldwide fishing capability can grossly reduce the catch of currently marketable fish and alter the relative species balance in a major way if uncontrolled and unregulated. The position proposed is to assign each coastal fishery to the adjacent state for management and licensing; to assign responsibility for anadromous fish to the country in whose waters the fish spawn; and to rely on multilateral arrangements for the pelagic fisheries. *The basic approach is to place priority on conservation of the resource.* This approach, in the case of the coastal fishery, has the important corollary that the fixed territorial concept is removed from the important fisheries domain, and should help relieve the pressures which appear to be driving territorial limits outward.

The Issue of Open Research

Our position with regard to the use of the ocean basins is largely in agreement with the positions of most other states. The principle of community ownership and international management has been accepted, but the question of the relation between a producing corporation and the international management is yet to be settled—and there is great resistance to such management conducting its own research while restricting research of member nations.

Except possibly for manganese nodule and phosphate mining, the deep-sea resources will remain inaccessible for many years. Therefore these questions are less immediate than the fishing and territorial waters questions, and even in the case of the nodules and phosphate beds the pressure for development may be resolved by the hidden question of the effect on individual states' economies by the introduction of new sources of specific minerals. Nevertheless, discussions relating to the use of the seabed have raised the specter of restrictions on freedom of research on the open sea. *It is and should remain firm U.S. policy that this freedom of research on the open sea continue.*

In a purely practical way, we as a world can never hope to realize any of the postulated benefits from the oceans if research is hampered. Even now it is proceeding at altogether too slow a pace to match the oft-stated expectations. International interference with research is far more serious than that on the national level. It has happened that scientific inquiry has been blocked in various disciplines in one nation or another at one time or another usually for ideological reasons. Fortunately for mankind, if not for that nation in particular, scientific inquiry advanced elsewhere. At a later date, the laggard nation was able to catch up, if not to repair the damage completely. This corrective is not available if the inhibition to science is on a global scale. More fundamentally, any further limitations on freedom of inquiry that are not for basic safety or the general welfare (such as those to control pollution) are a dangerous addition to a list of limitations that is already too large.

It is possible to understand and sympathize with the position taken by the developing nations. Mostly former colonies, they are sensitive to any possibility, however remote, that their share of the oceanic resources may be usurped by the more advanced nations who have the technology to exploit these resources. They transfer this concern to research as well, believing that their poor or nonexistent research capabilities put them at a gross disadvantage in obtaining their share of the resources. This could bring major oceanic development to a halt if such fears are translated into conventions restricting research on the open seas, because research and education do go together, and are not developed serially. Thus, halting exploration or research until the developing nations reduce the research gap would lead to a total slowdown, further frustrating hopes for fulfillment of the postulated benefits available to mankind from development of oceanic resources. It would also greatly impede applied research in nonextractive uses of the oceans such as meteorological research, which, for the immediate future, may be the most beneficial of all efforts.

RECOMMENDED COURSES OF ACTION

NACOA recommends means by which the United States may exert leadership based on its acknowledged advanced capabilities in oceanic technology. The 1958 Conference was successful largely because of the United States and the technical support that could be brought to bear on the deliberations. The generally formal, legalistic approach that has been followed in the last several years seems to be moving too slowly. If progress is to be made, we must change our approach by recognizing the obstacles to progress in negotiations and by altering our procedures accordingly. *Our principal recommendation is to engage other countries, particularly the developing nations, in as many joint projects with the United States as possible and in as great a variety as reasonable.* This en-

agement should be primarily at the technical level with the full cooperation of the involved government. Some of the harsher realities of oceanic research and development will be more widely understood and there will be improved ability to interpret the findings of others. This should go far toward allaying suspicions of unilateral exploitation. Or, from a different point of view, this should give the developing nations a better technical base to protect themselves in economic negotiations.

It happens that numerous U.S. programs exist at various levels of activity which could be employed toward this end. Aside from the necessary strengthening of the individual programs, the programs should operate in a coordinated way with the ultimate purpose of developing a better worldwide understanding of ocean technology and the value of a management approach to oceanic resources.

1. A first and important step would be greatly strengthening the office, in the Department of State, of the Coordinator of Ocean Affairs and Special Assistant for Fisheries and Wildlife. This Office has been very effective with its limited means in handling many fisheries problems, and has been supportive of U.S. research programs around the world and in species protection, particularly mammals. The success of this Office is based on its expertise and the relationships it has established with its constituent community in the United States. The problems, however, are too varied and too numerous for the Office to handle within its present means. It is this Office that has demonstrated the usefulness of joint research in the international realm by arranging for cooperative fisheries research.

2. Other governmental agencies have not been as effectively or imaginatively used. For example, the Agency for International Development has almost entirely dropped its programs in the oceans due to budget pressures. This lack of coordination seems difficult to understand at a time when Law of the Sea problems involve so much intradepartmental effort up to the Under Secretary's level at the Department of State. We recommend a vigorous AID program in ocean science and technology. There are a number of such efforts by the Department of Agriculture, with one example being the USDA's Economic Research Service, set up to work with AID for the purpose of enhancing international development in areas related to agricultural matters. By analogy, a similar decision could be reached to focus certain developmental activities in areas related to marine matters by a cooperative Department of Commerce/AID program. NACOA suggests this might be most logically assigned to the Sea Grant Program within Commerce's NOAA.

Thus, a new candidate for international programs is the United States Sea Grant Program. By analogy with our Land Grant Program it offers great promise. One of the great contributions of the Land Grant Program to the common welfare has been that of American agricultural technology, and the key element has been the educational contribution of our great

agricultural colleges and universities. Their dedicated students are to be found in the most remote corners of the world. They have been instrumental in helping feed the world's billions by introducing new agricultural and land management practices. We cannot properly compare the fledgling Sea Grant Program of the Department of Commerce with the Land Grant Program activity developed over the past century, but the potential is there. One possibility has already been noted. The Sea Grant Program could be made even more valuable than at present by introducing an exchange program for foreign students, particularly from the developing countries.

3. It was hoped that the International Oceanographic Commission (IOC) could serve as an important exchange mechanism between governments and during the period between important diplomatic conferences. It has been a major disappointment. For many nations it has become rather a political forum. A re-examination of the role of the IOC would be very much in order, looking to the possibility of having experts named as representatives rather than political delegates. If a major reconstruction takes place as a result of this review, it would be desirable to consider consolidating the oceanic and atmospheric interests.

4. Among the various U.S. programs the most useful could be the International Decade for Ocean Exploration (IDOE) of the National Science Foundation. It was originally intended to be a major international effort but has fallen far short of the intent. Its various current activities, such as GEOSECS (Geochemical Ocean Sections), the ocean buoy efforts, the midocean ridge studies, and the upwelling studies are very suitable candidates for massive international cooperation. Greater international participation at a higher level in these programs should be developed by more vigorous diplomatic activity, accelerated support to allow for more and a greater variety of projects, with funds specifically allocated for the support of cooperating developing countries. We note the important contributions of the IDOE to the oceanic pollution problem.

5. The National Marine Fisheries Service (NMFS) can play a vital role in exchanges with foreign governments—indeed they already do to a considerable degree—but this activity could be greatly enhanced, again with the motive of a mutual learning effort among nations. The NMFS is the basic support instrument for all of our activities related to biological resources. The NMFS should be strengthened to enable it to meet the increased demand for its services to related Law of the Sea activities, sea mammal protection, and additional fisheries conservation activities. The best support for a rational international program is a well-promulgated and sound scientific position—which is not presently available for many important issues.

6. There are military-related aspects apart from those of straight national defense requirements, and those warrant the most careful considera-

tion. Within the United States, in addition to various academic institutions and civilian branches of the Federal Government, the military branches—most notably the U.S. Navy—conduct considerable amounts of scientific research. Such research is intended to contribute to better understanding of natural phenomena. This is largely open research, it is not classified in nature. Outside the United States, particularly in a number of Latin American nations, much if not all of the oceanographic research is conducted by the navies, even research that would in the United States be conducted by civilian organizations. This suggests an important role for the U.S. Navy in extending its current relationships with these navies to include the exchange of research programs and techniques.

7. The National Oceanic and Atmospheric Administration's National Data Buoy Program and all the programs in general involving air-sea interaction, such as NORPAX and GATE, are extremely appropriate for intense international cooperation. There are immediate possible benefits for the participating countries regardless of a country's current level of research effort or sophistication, since many measurements of widely varying complexity are required. There are also appreciable cost savings for the individual countries. These programs can all use more support, particularly for those aspects which are directly related to international cooperation. Particular support is required to enable close contact between technical people at the working level.

8. Beyond these there are individual programs of sufficient magnitude and worldwide scope that they could carry important international involvements. The Deep Sea Drilling Project is a good example. It is also the unique tool now available for divining the potential resources beneath the deep ocean floor. The results of the research are now widely and voluminously disseminated. Greater international participation would help dispel the sense of inadequate knowledge that motivates the developing countries and builds pressures for increasing restrictions or widened territorial waters.

In summation, we do not underestimate the difficulties facing the negotiators who have to operate in a forum of representatives with widely varying backgrounds in technical development and varying nationalistic attitudes. It is as a result of our experience with these difficulties that we make our recommendations to engage other countries in suitable mutual efforts in the hope that a different and more positive approach may result which is aimed specifically at the sources of the difficulties.

Rehabilitating United States Fisheries

Fishermen have long contended with one another. Competition for a common resource has set commercial fishermen against the sportsman, one segment of the industry against another, one locality in the Nation against another, one nation against another. But now, as a consequence of technological improvement and overcapitalization, there exists the capability to fish to extinction. Awareness of this dreadful possibility is becoming universal and, NACOA feels, has produced the opportunity to achieve agreements by which to manage the ocean's living resources and conserve the ability to harvest them. This in turn would make it possible to create in the United States an environment which attracts private enterprise and thus leads to rehabilitation of a declining fishing industry. This section discusses the new awareness and the means by which a coherent program may be developed.

A COMMON THREAT

A gap exists between the declared national policy to rehabilitate the fisheries of the United States and the specifics of how to do it. One reason is that agreement on which of many problems is most important is no easier to come by than agreement on what to do if certain ones were picked. We are thus twice removed from coming to grips with the issues.

NACOA believes this situation is changing in the face of a common threat. We believe there is a general awareness—quite recent in origin—of what had previously been shrugged off as local by all except those affected. This threat, which now touches all coasts and all segments of the fishing industry and of sports fishing, is the threat to fish as a resource itself.

While there are underutilized fisheries, the potential for over-fishing exists by the international and interstate nature of much of the industry and the technology which underlies it. This potential for overfishing is stimulated by improving technology and by an economics which offers incentive to overfish to the fishermen who have little responsibility for management. It is not the husbandman who would kill the goose that lays the golden egg, but the hunter.

There has been a tendency to regard the decline of the world position of commercial fishing in the United States as a problem of international competition in which an unsubsidized, artisan-like, entrepreneurial, labor-intensive American industry has suffered the effects of competition with technologically-advanced, government-supported foreign fishing fleets. And in fact, the proportion of fish products imported into this country hit a peak, in 1968, of over 70 percent of the fish products used, though the average, 55 to 60 percent, is somewhat less.*

But these facts, serious as they are, divert attention from the more basic condition, masked by the rise in the total world catch, that fish resources are limited, that the potential exists in the world to destroy these resources, and that if our fisheries are not in fatal trouble now, they are going to be unless something is done about conserving the resource. The shrinking share by U.S. commercial fishermen of the growing catch has elicited suggestions for Government support to meet foreign competition, but this is a digression from the more fundamental problem, the threat to the resource itself. What purpose would any plan for rehabilitating the U.S. fishing industry serve if the fish themselves were gone?

ENVIRONMENT FOR REDEVELOPMENT

Adjusting to an approach which is resource-oriented rather than economics-oriented was the nub of many of the Stratton Commission recommendations; and it is the basis for existing fisheries policies which center on:

- obtaining the information on which proper resource management depends,
- minimizing institutional constraints such as Federal/State coastal jurisdiction problems, and
- adjusting conflicts in interest between sports and commercial fishermen, etc.

The Stratton Commission recommendations also touched on legislative, economic, and international issues, such as:

- the desirability of rescinding the requirement that a fishing vessel be American-made,
- the desirability of removing those types of control which impose inefficiency as an inhibitor to over-fishing, and
- the desirability of limiting entry to counter the inherent tendency of producers to overcapitalize when the price of entry is low.

Some of these recommendations have been translated into policy, others into official recognition as worthy bases for action. All remain valid today

* The U.S. catch, about two and a half million tons per year, has been relatively constant for 25 years, while the world catch has more than doubled in each of the last three decades. About half the U.S. catch is edible fish.

and some, such as limited entry, coastal jurisdiction problems, and sufficiency of biological information for resource management, remain crucial. But they have been upstaged by this new need of the hour—assurance there will be fish to catch in the future.

It is NACOA's opinion that assuring the resource, and the program for proper fisheries management which that goal implies, will provide the basic inducements for investment and venture. Limiting entry, modifying antiquated State regulations, developing new Federal/State guidelines, and improving the resource will also be necessary, but there need be no requirement for the kind of direct financial subsidy that can be both expensive and self-defeating.

We know this means borrowing trouble. In addition to adjusting and negotiating the conflicting fisheries interests within our own Nation (problems of resource management in the midst of jurisdictional confusion exist in inshore fisheries), we will have to assure our fishermen their fair share on the international stage.* It is our opinion that biologically determined regulations to assure a maximum sustainable yield could make worth to all the nations involved the cost of current restraint for future benefit. We believe the argument for rationalization of international agreements on conservation and allocation of catch can be made persuasive and the value of a share of the proceeds can be weighed by each nation as inducement to an agreement.

None of this is new. Resource management and bilateral or multinational agreements have arisen in response to specific fishery problems over the years and Fishery Conferences have proved their value. But they have in general been defensive efforts, evolutionary in nature, and often too local and slow moving. Furthermore we have, as a nation, shied away from approaching the problem of total conservation of fisheries partly because a course of action which depends on international agreement is not lightly undertaken, and partly because other elements of national policy were believed to have been involved whose importance, fate, and treatment can be quite separate.**

What is paramount from our point of view is the need to establish proper resource management as a matter of first priority. We must, however, be convinced that the price we pay for the potential benefit is justified. The Committee is aware that one reason for the decline of the fishing industry in the United States is that for the last 20 or 30 years commercial fishing has become less and less a factor in the life of the Nation. Unfortunately, fisheries are not regarded as part of the national wealth

* The preceding section on Law of the Sea discusses this in greater detail.

** In arriving at some agreement on the rights and responsibilities of coastal nations to the fish off their shores, the lumping of fisheries problems with those of off-shore mineral resource exploitation occurs in the politics of international negotiations if not in the actual agendas. Fishing and mining are totally different activities, but political combinations for one regard can carry over to the other.

as are submerged attached resources; the national efforts and energies devoted to fishing have thus declined, or at least not expanded in the face of growing foreign effort.

Thus, to raise the level of national effort in the fishing area by heroic means such as by a series of financial shots-in-the-arm, tariffs, quotas, and exclusions cannot automatically be assumed to be in the public interest. Any increase in effort, even control of the resource on a sound financial basis, must first respond to the questions: to what purpose? how? and how much will it cost?

IS IT WORTH THE EFFORT?

To what *purpose* do we wish to rehabilitate the domestic fishing industries? NACOA believes a rehabilitation effort is justified because the program necessary to do so can be expected to:

- advance established national policy,
- invigorate maritime activity,
- help reduce the present adverse balance of payments,
- increase domestic employment,
- contribute to the conservation and wise use of living marine resources,
- provide for expanded recreational fishing,
- arrest the trend toward total dependence on foreign fisheries, and
- provide an additional source of high-quality protein to the national food supply.

How do we propose to do it? NACOA believes the decline in the fishing industry should and could be corrected by providing a more attractive economic environment for individual venture and that at the same time the United States can contribute to the rational control of a global food resource. The time is now ripe, because of the threat to the resource itself, to find common ground in an industry which historically is beset with conflicting and fragmented interests. Before going into more detail as to how we suggest fisheries rehabilitation be undertaken, can we gage the required effort?

How much will it cost, and is it worth it? These are tangled questions. It is easier to ask for an assessment of costs and of benefits than it is to provide the answers and then be persuaded by them. One reason we think this has been especially difficult in the fishing area is because the traditional approach has taken the point of view of one segment of the industry at a time—the problem of the pelagic fishermen and the 200-mile limit, of the coastal fishermen and Russian and Japanese competition, of the sports fisherman and the disappearing sardine. Or the approach has been ambiguous because only a part of the problem has been attacked—such as limiting entry (but how do you get the States to agree and how long will it take?); reserve an increased share of the catch for

coastal nations (but what do we do while we wait for agreement?); provide loans (but do those who least need it benefit the most?); discourage the marginal operators who reduce the catch per unit effort for everybody without helping themselves very much (but what do you tell them to do instead?).

NACOA suggests that a way to override the difficulties of industry segmentation and of diverse local goals is to approach the question of a national fisheries goal directly and derive from it a comprehensive, consistent national planning basis for fisheries operations.

AN APPROACH TO NATIONAL FISHERY PLANNING

NACOA proposes a target for an increase in the share of fish supplied to the domestic market by domestic fishermen. U.S. food fish consumption is now 6 billion pounds a year of which the domestic catch supplies about 40 percent. Per capita consumption of this edible fish has remained constant for at least 30 years. (Consumption of fish for industrial use varies because it competes in the animal-feed market with other sources of protein.) Confining ourselves to edible fish and assuming per capita consumption will not change by 1980, we will then consume about 7 billion pounds of fish. A target of 3.5 billion pounds for domestic producers (increasing from 2.5 billion pounds in 1970) would increase our catch volume by 40 percent and reduce our dependence on imports for edible fish from 60 percent to 50 percent. This amplification would occur because the market is growing. What we propose is to supply the market increase and simultaneously move up to a larger share for domestic producers. A similar goal could be set for industrial fishery products.

We believe the implementing plan to achieve this goal can be developed in the following manner.

1. Determine present productivity of fishing areas of interest to the United States (including all inland fisheries). This assumes continued improvement in catch or production statistics.
2. Determine what the productivity of these areas, populations, or species could be in 10 years if a program of ideal conservation were adopted.
3. Determine which of the above programs should be adopted and implemented and to what degree.
4. Enumerate the steps that would be required and identify the agencies that would be concerned, e.g., Department of State on the matter of preferential access to coastal fish populations; Department of Commerce on internal maricultural efforts, etc.
5. Estimate how much additional fish and related products would be available to the consuming public as a result of this effort.
6. Relate this to domestic market requirements in 10 years and set feasible goals, programs, and time schedules to supply this need.

We have not carried out such a planning effort, nor do we underestimate its difficulty. We believe, however, that most of the capacity to do so resides collectively in the numerous agencies of government, and that the National Marine Fisheries Service (NMFS), Conferences and Commissions such as the international Convention for the Northwest Atlantic Fisheries (ICNAF), and the Food and Agriculture Organization (FAO) have much of the needed statistical information by which fish populations can be estimated by species and by area. We would be surprised, however, if even collectively they have it all in a form which would permit working backwards from a postulated national market to requirements of a resource without gaps in the analysis. It is not our intention to lay out a detailed plan to mobilize specific agency programs for this effort, but to offer a target by which such programs could be rationalized as a national planning effort under an appropriate lead agency—NOAA, for example—to strengthen the fishing industry. The experts can identify the programs, the budgetary requirements, and test our hypothesis that the benefit would be worth the cost.

Underlying these six steps to rehabilitate the fishing industry is the strategy that we must:

- assure the resource,
- assure the U.S. share of the resource by establishing the principle of preferential access, and
- accommodate the needs of both recreational and commercial fisheries.

Since no nation is in a position to take such action unilaterally, implicit in this proposition is the recognition that, at the Law of the Sea Conference to be held in 1973, stricter control of fisheries by the coastal nations and procedures for their enforcement must be established to make possible both allocation agreements and biological control of the resources. This will necessitate some readjustment in our understandings with some distant-water fishing nations. The issue is not a trivial one, and we address it also in our discussion on Law of the Sea.

RECAPITULATION

Let us review the reasoning of our proposed approach.

- The fishing resources of the sea are limited and subject to extinction unless managed so as to permit a sustainable yield.
- Present fishing technology, especially as developed by protein-deficient nations who themselves do not have sufficient fishing resources, threatens the existence of the species they catch. The economics of the situation drive each nation (indeed each fisherman) to catch specific fisheries even to depletion, because if they do not, they fear some other nation (or fisherman) might do so.
- International fishing arrangements which are species-specific have been

worked out between the interested parties so as to protect and preserve the resource. Because these agreements are usually in response to a downturn in catch, that segment of the industry is victimized before it can begin to recover.

- Many developing nations are anxious to reserve any resource to which they can now lay claim for development at their own pace. They should be willing to agree to aspects of control and management which respect their future.
- The time is ripe for reaching agreement among nations for control of fishing.
- In order to elicit agreements among many nations, the basis of resource management control would have to be biologically rather than politically determined.
- With the fishing resource assured over a period of time sufficient to attract investment, and our national share of the catch reasonably predictable, U.S. private enterprise should be depended upon to harvest it profitably.

The six steps by which a plan for an increased share of U.S. market may be developed are to determine (1) the present productivity of the fishing areas of interest to the United States, (2) their potential under ideal conservation conditions, (3) the necessary critical conservation methods, (4) the agencies which should bear the responsibility, (5) the increased supply of fish which would be available to the domestic market, and (6) a market penetration schedule.

We recommend that NOAA be assigned the lead agency role for developing such a plan, verifying its economic and operational feasibility, and—with Department of State collaboration—for proceeding with its implementation.

The time for us to act is now because foreign competition and the threat to fish resources are now recognized as a national problem rather than a local one. Like the land when the frontier began to disappear, the oceans too now need management in the common interest of those who would harvest its bounty today and be custodian for generations to come.

Weather Modification

Both deliberate and inadvertent weather modifications are possible today. Potential benefits and potential risks are great and raise grave social, legal, economic, and jurisdictional issues. In this section NACOA discusses the effort it believes desirable in: legislation to define rights, responsibilities, and a sense of purpose; research to hasten and extend our abilities to reduce risks; and international agreement to promote peaceful uses of weather modification and to eschew its hostile uses.

ON THE THRESHOLD OF ENVIRONMENTAL CONTROL

NACOA is persuaded that we stand on the threshold of a new era of environmental control. The scientific literature indicates today, that under certain limited conditions, man can increase or decrease rainfall, increase or decrease snowpack in the mountains, and clear fogs over runways and highways. Claims of suppressing hail in the Soviet Union are impressive. A large-scale effort is now being mounted to develop better methods of hail suppression in the United States. The capability to diminish the force of a hurricane (though not the ability to steer it) seems to be near at hand. Further research and development make it likely that some of today's limitations will soon be removed and man may before long deliberately exert an even greater influence on the weather. These developments require our serious attention now.

Our ability to treat these problems has been increased by advances in mathematical modeling of atmospheric processes, increases in the speed and capacity of computers on which these models are run, and new forms of instrumentation. Delivery systems for cloud seeding (rockets, land-based and airborne nuclei generators) and predictive methods for local meteorological conditions are being rapidly developed. These advances make possible methods of measurement and diminish the reliance on a long expensive series of statistical observations which seek to filter a faint signal from a large background "noise." The result is an acceleration of the entire field.

While our capabilities and understanding are growing, so are the dangers. In some parts of the United States operational weather modification has been carried out for nearly twenty years and operations are also being carried out in many foreign lands. The results are often unrecorded or unpublished. There is also increasing concern that man's activities inadvertently affect the weather and thereby modify the climate. The more we have learned about deliberate weather modification, the more reason we have to be concerned over the inadvertent effects of various substances now being released into the atmosphere. These effects can extend to the global scale as well as being local in nature.

The potential benefits from weather control and conscious climate modification are very large. So are the potential risks--particularly from inadvertent climate modification. Furthermore, any technique enabling man to control large-scale phenomena necessarily raises grave social, legal, and economic issues where effects extend across state and national boundaries. There is still time to address these issues rationally before operational weather modification grows at a pace which forces hasty moves. This opportunity should not be wasted, and NACOA believes that the time has come to take action along several broad fronts.

RECOMMENDATIONS FOR ACTION

NACOA sees five areas in which action is required.

- *Legislation:* Legislation to define rights and responsibilities of citizens, the States, and the Federal Government is needed promptly. So is legislation to define means for regulating and licensing private operators, organizational responsibility in the Federal Government, and above all, a sense of national purpose. More specifically, legislation is needed to designate responsibility in ameliorating those weather disturbances that produce public states of emergency, to establish the procedures under which the Federal Government and its employees may legitimately modify the weather, to define the rights and responsibilities of commercial weather modifiers, and to designate responsibility (probably Federal) for monitoring inadvertent weather modification. Regulation is also badly needed, but the issue of separating the responsibility for regulation from promotion of operations, always delicate, deserves more study.
- *Research and Technology:* Development of the technology by which precipitation can be increased, decreased, and redistributed should be hastened through increased funding for basic research in cloud physics and the optical properties of particulates, for computer modeling, experiment design and field work, and the development of remote-sensing devices (e.g., satellites and Doppler radar).
- *Hurricanes:* Research and development of the technology to mitigate the effects of hurricanes should be accelerated. This may involve mov-

ing Project Stormfury from the Atlantic to the Pacific, where the greater incidence of this type of storm makes the cost-effectiveness much higher.

- *Public Policy:* A detailed public examination of the policy issues inherent in weather modification should be undertaken. It seems clear that operational weather modification will open the way to substantial social benefits, but the matter of potential social losses cannot be dismissed out of hand. Increasingly the question will be asked "*Who* benefits from weather modification?" All major consequences of large-scale operational programs should be assessed in advance of their implementation. NACOA believes both national and international reporting systems should be developed. Rarely—if ever before—has there been a more attractive opportunity for creative thinking and planning regarding the impact of a potential technological development upon international relations. This opportunity should not be lost.
- *International:* International agreement should be arrived at and the necessary institutional arrangements developed to eschew the hostile uses of weather modification and to investigate inadvertent changes in the global climate. The Global Atmospheric Research experiment now planned for 1977 can, with some other activities during that period, provide a superb tool for analyzing the vital interaction between long-term oceanic changes and natural or man-made climatic changes. It may be desirable to have an international conference, say in 1974, to discuss issues such as promoting the peaceful use of weather modification and possible collaborative efforts in inadvertent weather modification. The national laboratory dedicated to weather modification, proposed by a National Academy of Sciences study, should be internationalized.
- NACOA wishes to associate itself with the position taken by the National Academy of Sciences that in order to safeguard the life-sustaining properties of the atmosphere for the common benefit of mankind, *the U.S. Government is urged to present for adoption by the United Nations General Assembly a resolution dedicating all weather-modification efforts to peaceful purposes and establishing, preferably within the framework of international nongovernmental scientific organization, an advisory mechanism for consideration of weather-modification problems of potential international concern before they reach critical levels.*

HISTORICAL BACKGROUND

Before discussing existing efforts and suggested changes in more detail, it is useful to review briefly the history of weather modification and how we got to the present state. The era of scientific weather modification began

in 1946 when Vincent Schaefer and Irving Langmuir demonstrated that it was possible to initiate precipitation by dropping pellets of carbon dioxide from an airplane into a cloud composed of water droplets at below-freezing temperatures. This dramatic development led to Project Cirrus, a broad theoretical and field program intended to establish a strong scientific basis for cloud modification. Perhaps the most important scientific finding was that silver iodide crystals were as effective as dry ice in transforming supercooled clouds into ice-crystal clouds, and thence to rain. More spectacular—and more controversial—were (1) an experiment with seeding a hurricane off the east coast, with inconclusive results and (2) experiments by Langmuir that convinced him (but very few others) that periodic seeding of the atmosphere with silver iodide in the southwestern United States produced corresponding periodicities in the rainfall 2,000 miles to the east.

Enough interest was stimulated by Project Cirrus to set in motion two other agency projects. The first was the Cloud Physics Project under the auspices of the U.S. Weather Bureau, the Air Force, and the National Advisory Committee for Aeronautics, conducted from 1948 to 1951. The second was a 5-year Department of Defense project which began in 1952. These serious efforts yielded inconclusive results because of their brevity, the primitive state of the art of instrumentation, and partly because the design of the experiments was not sufficiently sophisticated to filter out the natural variability of the atmosphere.

Meanwhile, a determined band of meteorological entrepreneurs moved in and succeeded in placing nearly ten percent of the land area of the country under commercial seeding, from strategically located silver iodide generators, at an annual cost of between 3 and 5 million dollars. The movement spread to 30 other countries.

Sufficient interest and controversy were generated by these results that Congress established in 1953 an Advisory Committee on Weather Control to study and evaluate the results of private and public experiments. Its report issued in 1958 was cautiously optimistic, concluding that increases of 10 to 15 percent in rainfall were induced by seeding spring and winter storms in the mountainous areas of the western United States. More long-term research was recommended with special responsibilities being assigned to the National Science Foundation. The Advisory Committee report was subjected to considerable attack, primarily on statistical grounds. However, the NSF did mount a modest but sound program of fundamental research and field experimentation, which laid an important basis for the next decade. As a result of extravagant claims and questionable practices by a few commercial cloud seeders, and controversy on statistical interpretation of experimental results, the field did not flourish during the early 1960's.

A two-pronged study was initiated in 1963 and 1964, by the National

Academy of Sciences and a Special Commission of the National Science Board. Their reports, issued early in 1966, were moderately optimistic. The conclusions of the 1953 Advisory Committee that the order of a 10-percent increase in precipitation can be expected from seeding orographic storms in western United States were substantiated. Subsequent studies by the Academy and the Interdepartmental Committee for Atmospheric Sciences have reinforced early findings.

PRESENT STATE OF THE ART

- For certain meteorological conditions the evidence is persuasive that it is possible to increase precipitation by substantial amounts and on other occasions to decrease precipitation by substantial amounts.
- There is ambiguous evidence that the effects of seeding may influence precipitation at points 100 to 200 kilometers from the site of the seeding. This matter must be clarified.
- It now appears possible to acquire the additional knowledge necessary to predict the effects of seeding on a wide variety of cloud types and systems (convective, orographic, stratiform, migratory storm systems, etc.) in different geographic areas from reasonably realistic computerized cloud models.
- Supercooled fog can be dissipated on an operational basis.
- There is encouraging evidence that hail can be suppressed.
- There is encouraging evidence that the intensity of winds in a hurricane can be reduced.
- There is evidence that further development will lead to operational techniques for decreasing the frequency and duration of cloud-to-ground lightning discharges, with a subsequent reduction in forest fires.
- Advances in remote-sensing techniques are the first steps toward methods to modify tornadoes.
- No completely accepted technique yet exists for dissipating warm fog, but the potential economic benefits and the encouraging prospects of such a capability warrant further research.
- The prospects of inadvertent modification of weather and climate by changing the chemical composition of the atmosphere, the particle concentration, or by the discharge of heat are so real, and so likely to be realized within a matter of decades, that a major program of research appears to be warranted.
- Weather modification issues now reach to the stratosphere. It has been suggested that exhaust emissions from SST's may decrease the ozone concentration at high altitude and lead to an increase in ultraviolet radiation at the Earth's surface. Fortunately, the way appears clear to resolve this question before SST's are operational.

Ongoing National Projects

The Federal programs in weather modification are coordinated under the Interdepartmental Committee for Atmospheric Science (ICAS) of the Federal Committee for Science and Technology. A number of the research projects representing voluntary combinations of resources of several of the interested Federal agencies are National Projects. They include snowpack augmentation, surface-wind reduction in hurricanes, increase of natural rainfall in areas where needed, reduction of damaging hailfall, spreading heavy Great Lakes snowfall over a wider area, and improving visibility in warm and cold fogs. Though agency funding for weather modification has lately been increased—in the last 2 years from \$16 million (FY '71) to \$20 million (FY '72 Estimate) to \$25 million (FY '73 Budget)—the projects have characteristically been inadequately coordinated, underfunded through fragmentation, often not backed up by basic research, and undertaken with obsolete equipment. This is not a criticism of any specific project, but of the lack of central planning and execution.

SOME POTENTIAL BENEFITS

Although too much reliance should not be placed on benefit-to-cost analysis, attractive ratios are already being achieved in some areas of weather modification. The Southern California Edison Project in the upper San Joaquin River Basin in the Sierra Nevada range has been operated continuously every winter since the 1950-51 season. Although the exact figures are proprietary, the meteorologist in charge reports that annual runoff has been increased 8 percent over the lifetime of the project.* Bureau of Reclamation studies indicate something like a 10 to 1 ratio of benefit-to-cost for orographic precipitation enhancement of this sort.** However, these operational programs are limited in number and have remained relatively constant through many years. Many programs having large potential benefits at attractive operational costs are not operational today due to limitations in the present technology. This translates to limitations on the resources (laboratory facilities, scientific manpower, instrumented aircraft, computer time, etc.) necessary to improve the technology.

Hail suppression has been operational in the USSR for many years with reported benefit-to-cost ratios of as high as 17 to 1. Lightning-caused forest fires produce losses in excess of \$100 million annually and destroy valuable forests. An operational technique for lightning suppression is expected to yield a benefit-to-cost ratio of at least 5 to 1. A semioperational program in Alaska now beginning its fourth season reflected this ratio in the 1971 summer season. Cold fog dispersal over airport runways is now op-

* Private communication from Robert D. Elliott, North American Weather Consultants, Santa Barbara, Calif.

** "Some Considerations of Benefit-to-Cost Relationships Regarding Use of Weather Modification," by Loren W. Crow, April 7, 1972, Contract to NOAA, LWC #99.

erational, where this type of fog is prevalent, with a return in benefits six times the cost of the program. Warm fog is even more prevalent, and it seems likely that a similar benefit-to-cost ratio will be attained when the operational techniques for its dispersal are perfected.

It is estimated that the hurricane modification program alone, when operational, would cost about \$5 million annually and could reduce property damage and related costs by \$100 million annually, a benefit-to-cost ratio of 20 to 1.

There is another vast area which suffers a shortage of annual precipitation, reaching drought proportions in far too many years. This is the northern Great Plains area of the country. In this region, where summer rainfall is both scanty and sporadic, crop-production technique is based on trapping a portion of 1 year's rainfall to help support grain production in the subsequent year, and one crop is produced each 2 years per unit of land area. On the basis of soil quality, the potential exists for annual crops given a modest increase in rainfall. This area, which has been largely ignored by the Federal Government in its weather modification program, should be explored.

TECHNICAL OBSTACLES TO PROGRESS

Progress in any technical endeavor depends upon our theoretical understanding, our ability to measure, our facilities for experimentation, and our ability to mount and manage large-scale field experiments. We have made significant progress in all four areas in the last decade.

Understanding

In order to make progress in the National Projects and other applications of weather modification, a great deal more must be learned about the natural weather processes and how these processes can be modified to bring about the desired effect. Some of these areas where measurements are essential include:

- origin, detection, and counting of natural ice nuclei;
- modes of nucleation, optimum particle size and numbers, and inadvertent sources of artificial ice nuclei;
- detection, counting, and variability of natural cloud condensation nuclei;
- inadvertent sources of artificial cloud condensation nuclei;
- water vapor, liquid water, rate of riming, cloud drop size, etc.;
- ice crystal type and size; and
- temperature in cloud, vertical and horizontal flow, electrical field, etc.

Instrumentation

The key to increasing our knowledge of the processes involved is accurate measurements of all of the needed information. This requires de-

velopment of improved instruments and the means to test and calibrate these instruments under actual or simulated conditions. The priority areas requiring attention are: (1) airborne instrumentation that can rapidly and accurately provide measurement of the type discussed in the preceding paragraph; and (2) more effective nucleating agents and more efficient methods of getting the nucleating agents into the target area.

Significant progress has been made in recent years in satellite technology and in remote sensing from aircraft and from the ground. NOAA's coming high resolution geostationary satellite and its developments in Doppler and optical radars and other remote-sensing techniques will make significant contributions to the advancement of the technology of weather modification. Satellites and remote sensing should be able to tell us something of the physical changes taking place within the seeded cloud and thus aid in the evaluation of field experiments.

In the final analysis, however, it is the precipitation on the ground and the runoff into the rivers and reservoirs that count where precipitation enhancement is the goal. Measuring the true difference in precipitation and runoff between seeded and unseeded areas continues to be the best hope for assessing results, but a vast improvement in this area is needed. Here radar, in combination with recording rain gages, represents the primary hope.

Facilities

A significant one-time investment in facilities will be required in order to support the developmental programs. The more important of these include:

- cloud chambers to stimulate the natural environment to enable the study of the natural processes involved and how they are affected by artificial stimulation.
- a test and calibration facility. NOAA has in operation the analog to what is needed here, i.e., National Oceanographic Instrumentation Center. Here new instrumentation developed by both public and private organizations are tested in modern facilities, and reports are issued as to their accuracy, reliability, maintainability, etc. The Center also provides a calibration service to both public and private organizations. Such a facility is urgently needed in the weather modification field.
- modern well-instrumented aircraft. A majority of the needed aircraft already exist in the private sector. The Federal Government need only be concerned with providing the minimum number of heavy aircraft equipped with sensing and recording systems, radars, and seeding capabilities required of the program. NACOA notes with concern the need to cancel NOAA's planned move of its hurricane modification project (Project Stormfury) to the Pacific for lack of such aircraft

Field Experimentation

As discussed previously, the Federal agencies are currently engaged in a variety of field programs. In almost every case the field programs are restricted by limited resources of one kind or another to the point where the programs are suboptimal and progress has been at a snail's pace. One would hope that the primary objectives of Federal programs to enhance rainfall, eliminate fog, and suppress hail and lightning would be the transfer of this technology to the private sector where it could produce an expansion of existing industries and create new ones.

What is badly needed is a field experiment which brings to bear all of the resources that can contribute to the success of the experiment. The experimental area might be somewhere in the Great Plains and should operate on a year-around basis. Experiments should be carried out with summer cumulus, winter upslope stratus, and winter migratory storms. The program should employ the latest in meteorological satellite and remote-sensing technologies, well-instrumented aircraft, and an increased density of surface, upper air, and radar observations of the National Weather Service. The emphasis should be on providing the tools necessary to fully measure and observe the physical and dynamic changes taking place both naturally and under the influence of seeding. Maximum effort should be made to determine results through direct observation of the changes in the cloud. In addition, the experiment should be designed in such a way as to provide optimum conditions for a statistical evaluation (e.g., random crossover design). The technologies developed by NOAA in Florida with dynamic seeding of tropical cumulus, by NOAA with seeding of low stratiform clouds over the Great Lakes, and by Bureau of Reclamation supported programs in the Dakotas and Texas provide the initial groundwork for this effort. The field experiment should be concentrated in an area less than the size of a State. From this experiment should come the basic knowledge which is needed for most phases of weather modification.

INSTITUTIONAL FACTORS AND REGULATION

Weather modification today within the Federal Government is carried out by seven agencies to meet their individual mission needs. The Department of Transportation is concerned with the effect of fog on airport operations, the Department of Agriculture is concerned with the reduction of lightning-caused forest fires, the Department of the Interior is interested in increasing the water supplies in the West, and the Department of Commerce is interested in abating hurricanes and other severe storms and in reducing or increasing precipitation for a wide variety of purposes. What is lacking is a central focus for the overall effort. Some progress has been made in this direction with NOAA having been assigned responsibility for monitoring the weather modification activities

within the country, both Federal and non-Federal. More importantly, though, is the need to have a single Federal agency responsible for taking the lead in development of the technology of the overall program. The present fragmented approach is moving the country ahead in weather modification in an erratic fashion.

Certain basic facilities and services which represent common needs of most Federal programs do not exist. Instrument development programs are critical to progress in weather modification, yet no focused program in this area is in evidence. There is a strong need for a central Federal facility to test, evaluate, and calibrate instrumentation and equipment used in field experiments. Again, no such facility exists. The lead agency should be responsible for doing the type of field experiment recommended for the Great Plains area. It should focus on drawing on the research results of the NSF and other Federal agencies and testing these in an operational environment. The end objective would be a feedback to the mission-oriented programs of the other Federal agencies, and a technology transfer to the private weather modification sector.

There is an immediate need for some form of regulation. As the Federal Government invests increasing resources in major field projects such as the National Hail Research Experiment and the Great Plains project, it becomes imperative that these experiments not be compromised by other seeding activities on their peripheries. To illustrate the problem, there recently was a test carried out to determine whether a seeding program upstream of a field project could be affecting the project. The results showed that 20 to 30 percent of the seeding agent introduced 100 miles upstream was actually contaminating the field project. In addition, the National Science Foundation has reported that two major weather modification projects supported by the NSF in the western United States were seriously compromised by unregulated cloud seeding in the vicinity of the projects. In one of the cases, the Foundation investment of over a quarter of a million dollars was negated by the lack of regulation.

Regulation at this time should be the minimum necessary to ensure that critical Federal experiments are not vitiated as a result of contamination by a nearby seeding activity and to ensure that all commercial operators are licensed and meet certain specified standards to protect the populace from unsafe seeding procedures.

EVALUATION

Experimental weather modification is an activity that does not lend itself to demonstrating a precise connection between actions and outcomes. The accuracy of assessment after the fact can be increased by better use of advanced instrumentation such as geostationary satellites, modern radars, computer models, aircraft probes, nuclei counters, etc. However, even with the best of instrumentation it is impossible to measure all variables over

a region of several hundreds of square miles. Even with unlimited funding, exact evaluation of an experiment is not possible. In the case of operational weather modifications, there are economic limits to the instrumentation that can be afforded. Therefore, decisions regarding operation must be made with only part of the data at hand. Whether the missing data are of serious consequences depend upon the specific circumstances. If operational weather modification is to be more generally applied, the decision making apparatus for determining when and how to permit operations needs to be improved.

Therefore, NACOA wishes to emphasize need to integrate statistical and other analytical approaches (mostly computer modeling) to reduce the uncertainty in evaluating the efficacy of weather modification. NACOA urges all agencies that sponsor research and development in weather modification, and all those who conduct operations, to explore and utilize both statistical and nonstatistical techniques and to conduct studies designed to bring these approaches together.

The Coastal Zone

An increasing population and increasing economic activities, poured into the attractive but confined space of the coastal zone, give rise to a host of conflicts and problems because of the incompatibilities of unrationalized multiple uses. The coastal zone is exceedingly complex naturally, socially, and economically, and every aspect of planning, negotiation, understanding, agreement, and implementation seems to involve many levels of government. As a result the management aspects of the coastal zone take on greater significance than is usual where an intimate mix of institutional and scientific activity is required. NACOA finds that prompt action on coastal zone management problems is urgently needed. These needs have already been pointed out in many reports including the milestone Stratton Commission Report issued three and a half years ago. NACOA is disturbed at the lack of definitive progress by the Federal Government on this matter, and the findings strongly underscore the need for action. State governments are already moving in this area, and the public is calling for action. NACOA recommends prompt enactment of coastal zone legislation.

THE NEED FOR LEGISLATION

Pressure is building in the coastal areas of the United States. Increasing population and increasing economic activity, crammed into a confined space, mean myriad conflicts which result from incompatibilities of unwise and unconstrained multiple uses.

The coastal zone is a pressure cooker precisely because its bounds are limited. Yet because it is the interface between land and sea it is a zone which is more complex naturally, socially, and economically than the continental interior. In addition, it is a zone in which every aspect of planning, negotiation, understanding, agreement, and implementation seems to involve more levels of government than any other zone.

There is ample evidence that the public is impatient with the lack of meaningful progress in this area and is demanding much more than a token commitment on the part of its government. The problems of the coastal zone now have too direct an impact on too many people for its

issues to be conveniently swept under the rug. An impressive manifestation of these concerns was evident at the recent Stockholm conference on the environment where important American citizens, acting as representatives of several hundred nongovernmental organizations, came to be heard on these and related matters. The fact that they felt impelled to act on their own, outside the normal channels of government, testifies not only to their great concern for the subject but also their lack of confidence that the established system would produce an adequate response.

The problems of the coastal zone have an extraordinary range: Usage problems include deep-draft oil terminals to alleviate the growing energy crisis vs. conservation of shore areas for recreation and protection of living marine resources; commercial vs. sports fishing; condominium development within jumping distance of the breakers vs. preservation of the dunes for their inherent physical and aesthetic value; marinas, housing developments, and industrial sites vs. wetlands; roads vs. hiking trails. Technical and scientific problems include the need for understanding the processes of circulation, stability, waste-receiving capacity, marine productivity, and habitat to mention only a few. Then there are the problems of man's impact on the ecosystem from dredging and filling, engineering and construction, contamination of water, water diversion, and many others. The list is almost endless.

Several features are worthy of special mention. Since it is the tidal tributaries and the nearshore waters of the coast that receive outfall effluents and surface and subsurface drainage and are immediate to atmospheric injection sources, pollution of the oceans is determined largely by what happens in the coastal zone. Most of the species on which commercial or recreational fishing industries depend are dependent on the waters, wetlands, and bottoms of the coastal margin. Finally, the coastal zones of the world are gateways to the oceans through which must pass most commerce serving man's marine-related needs. The regulation of man's activities in the coastal zone involves balancing social, economic, political, and national security trade-offs of great complexity with local, state, regional, national, and international consequences.

This situation has been recognized for some time and this recognition has during the last 5 or 6 years led through a lengthy series of studies, commissions, and policy resolutions to a gathering momentum for comprehensive legislative action, presently represented by two well-conceived coastal zone management bills under active consideration by the Congress. NACOA feels that the passage of suitable legislation has been delayed much too long and urges prompt enactment of one of these. At this time, we strongly favor legislation devoted exclusively to the management of the coastal zone unencumbered by the larger issue involved in land-use management legislation applicable to the entire nation. We feel it is vital that this legislation also provide for the establishment of research and

technical advisory sources closely coupled to each level in the management hierarchy including local, State, and Federal echelons. The basis for these recommendations follows.

THE PROBLEM

It is widely recognized that the coastal zone problem is first and foremost a management problem, and that the crux of the management problem is jurisdictional.

This is not to say that the other elements typifying a management problem are all in hand. The Stratton Commission, for example, mentioned several, including the neglect accorded marine affairs by State governments at that time and their failure to develop and implement long-range plans. Furthermore, there is a continuing and undesirable gap between those responsible for coastal zone decisions and the technical and scientific expertise needed to help them assess the consequences of their decisions before they are made.

But the last few years have seen a growing awareness of the importance of the problem and a broad consensus regarding the major goals. These were described by Lawrence, the Executive Director of the Stratton Commission, during the 1969 Hearings on the Coastal Zone, as including:

“. . . the urgent need to halt the deterioration of the Great Lakes and estuaries, provide more adequate seaside recreational opportunities, improve our ports, accommodate expanding industries seeking shoreline space, capitalize on opportunities to make more effective use of the waterfronts of coastal cities, and protect our coastlines from accidental oil spills and other forms of pollution.” *

It is our conviction that all these goals can be met. The plans to do so must be drawn up in such a way as to take advantage of the full range of possibilities represented by the coastal zone as a whole, adjusting local plans to keep within the guidelines derived from the larger context. For this, resolving the jurisdictional problem is mandatory.

To see why this is so, consider the ownership of the coastline for example. Excluding Alaska** about 70 percent (26,000 miles) of the 37,000 miles of U.S. shoreline is in private hands, 12 percent (5,000 miles) is

* "Coastal Zone Management Conference," Hearings before the Subcommittee on Oceanography of the Committee on Merchant Marine and Fisheries, House of Representatives, 91st Congress, October 28-29, 1969.

** Prior to the recently approved Alaska Native Lands Claims Settlement Act, the extent of whose impact on land ownership in the coastal zone is not yet known, only 1 percent of Alaska's 47,000 miles of shoreline was privately owned. Most of it (88 percent or 41,000 miles) is owned by the Federal Government, and the rest (11 percent or 10,000 miles) by State and local governments. Less than one-fifth is in any way developed, and more than half of that is used for recreation. In "the lower 48" plus Hawaii, more than 40 percent is developed, two-thirds of which is used for recreation. "Report on the National Shoreline Study," Department of Army, Corps of Engineers, August 1971.

owned by State or local governments, and 11 percent (4,000 miles) by the Federal Government. The ownership of nearly 3,000 miles or 7 percent is uncertain. Seaward below mean high water, the State generally has jurisdiction, in most cases out 3 miles.

Although Alaska's coastal zone has important management problems, those with difficult jurisdictional properties lie elsewhere, and this discussion will focus on these. The greatly complicating factor in the non-Alaskan coastal zone is of course the problem of how to deal both equitably and wisely with the private interests involved when they begin to conflict with each other or the public interest. One illustrative statistic—two-thirds of the 2,700 miles of critically eroding shoreline is privately owned, virtually all of it under extensive development. And "significant" erosion affects over 40 percent of the shoreline, again much of it traceable to man-made developments.*

Accordingly, when NACOA undertook to review the present status of the coastal zone management problem, it arranged for briefings from representatives of local governments, State governments, intrastate and interstate regional commissions, as well as from the major Federal agencies involved, the Department of Interior, the Department of Commerce, EPA, the Department of Defense (including both the Corps of Engineers and the Navy) and the Department of Transportation (the USCG). In addition, points of view representative of other Federal agencies, industry, and of the conservation community were also sought. Using the judgment of knowledgeable Committee members to supplement these briefings, we feel the following factors are of special significance.

- Though what is done on land does affect the coastal zone, the major indicators of impact are marine. Hence, the coastal zone poses unique problems for management, many differing in kind as well as degree from those facing inland land-use management.
- The coastal zone—and its problems—differs from one place to another in fragility and the need for protection, as well as in biological productivity, and the presence of mineral resources. Management approaches and priorities for early attention should differ for estuaries, wetlands, exposed beaches, and unique areas such as the Everglades from those applied to more stable systems such as the coast of Maine, areas already heavily developed such as New York Harbor, or where extensive oil or mineral deposits underlie the region such as along the Gulf Coast of Louisiana.
- Priority attention and management decisions should also be determined by the relative severity of the environmental impact of the various types of activity proposed. Activities producing permanent or

* "Critical" erosion is that where action to stop it is felt justified in the light of economic, safety, demographic, or ecological factors. "Significant" erosion is undesirable but efforts to arrest it may not be justified in these terms. *Ibid.*

preemptive changes demand that a wider context and broader set of considerations be applied to regulatory decisions than do activities whose impact can be controlled or rectified.

- It should be recognized that the cumulative effects of multiple similar activities are far different from those of a single case. The effect of one offshore oil well or of one retirement village is not the same as that of 25,000.
- The scientific knowledge needed as a basis for sound management decisions is spotty and generally inadequate. Institutions for bridging the gap between existing knowledge and contemplated action are relatively few and weak.

COASTAL ZONE NEEDS FROM SEVERAL VANTAGE POINTS

Since local, regional, State, and Federal interests and jurisdictions may all impinge at once on various coastal zone issues, and the management problem has a large jurisdictional element, NACOA found it instructive to hear representative views from each level. We will typify them in what follows by quotation and by paraphrase. While they differ in a number of respects, there are two related jurisdictional principles which all these views tend to support:

- Regulatory authority must be associated with existing political entities or combinations of such entities even when the physiography or other features of the coastal zone region to be managed are not completely coincident.
- The State and its constitutional powers make it the key political entity in coastal zone management in that localities and intrastate and interstate regional authorities derive their powers from the State or States involved.

Local Government

We note that local government, be it in the city in highly populated areas, or the county in areas of low population density, is closest to the people, and its elected officials must raise much of the money to carry out decisions made regarding their communities. The system is likely to work best if they have some latitude in land-use decisions, subject to conformity with reasonable environmental standards and carefully conceived regional or state guidelines. The greatest current handicap is the unavailability of the right kinds of expertise. To use the words of a discussant,

"We are in an era when politicians, managers, and scientists of many disciplines must get together in a systematic approach using all our resources . . . There is a need for adoption of standards, criteria and priorities at the Federal and State level within which local agencies can operate . . . There is a need for the Federal Government to identify nationally significant areas and to identify uses in those areas, to include Federal procurement of land if necessary. The States should follow suit within their jurisdictions.

"In the remaining areas, local government should be permitted to act within criteria established. Should the criteria work hardship on local agencies, there must be subvention . . . Local government must have more ready access to either direct interdisciplinary advice or funds with which to obtain such advice . . . Private property owners must receive some protection against costs disproportionate to benefits they may receive." *

State

It is at the State and local levels that most of the pressures have been felt and most of the attempts at solution have been made. Though helpful legislation has been passed, the result is what one would expect from catch-as-catch-can solutions—the problems simply get bigger and move up in priority. Although several States have moved toward comprehensive coastal zone management arrangements, this has not been, in general, true in the past. State experience can be most instructive for action at the Federal level. As one State official put it, the problems characterizing State efforts at coastal zone management during the last 20 years have arisen from "expedience, inexperience, and lack of political interest." Programs have often grown without sufficient statutory authority, guidelines, or priorities, resulting in a tendency to make ad hoc decisions on each issue as it arose. Continuing demands for more and more mineral production, flood control, hurricane protection, navigation channels, and the reclamation of wetlands for human habitation and agriculture, he informed NACOA, have produced tremendous pressures on an ill-defined set of environmental priorities.

"Such an approach to environmental management, at best, is partially effective and only prolongs the agony of environmental degradation by partial control and regulation of specific destructive activities and projects but which fails to accomplish very much control over the accumulative and quantitative effects of multiple actions. At worst, (there) are cases of overzealous environmental agencies and individuals which take a completely negative position on all environmental manipulation and which would bring progress to a halt. Such an inflexible position is self-defeating since neither the executive and legislative branches of government nor are industry and the public prepared for such drastic change. The probable result will be rebellion against environmentalists and the environmental position unless all branches of government and a majority of the public is fully aware of the need for and the ramifications of such regulatory severity . . .

". . . many of the same errors are being repeated on a national level as the Federal Government wrestles with problems of coastal and environmental management. From the state's position, the Executive Branch of Government has not spelled out the national environmental policy in sufficient detail and clarity, particularly in the area of setting priorities, and there is much evidence that the Legislative Branch is still proposing vast public works projects and industrial development that are environmentally disruptive while expecting and promising environmental protection and management in the same locality. Legislative demands for incompatible activities create an almost impossible position for state

* "Statement for Presentation to NACOA," 27 April 1972, George Dawes, Harbor and Tidelands Administration, City of Newport Beach, Calif.

and Federal administration to resolve and guarantee environmental stability . . . "Much more research specifically aimed at gathering data to make environmental management determinations is needed:

- The research should be associated with and geared to furnish data to specific planning bodies or agencies.
- Research may be carried out by Federal agencies, state agencies, and universities but it should be specifically oriented to produce needed answers in the shortest possible time. Vague, undirected or uncontrolled research programs, particularly in universities, will be inefficient and costly. . . ."

In conclusion, NACOA was told,

"It should be obvious that the technical personnel of the states is more familiar with and in a better position (than the Federal Government) to make local judgments concerning environmental impacts. Local political pressure and public demand, however, may negate efficient local management unless specific national and state environmental priorities and policies are developed.

"Once a clear and well-defined national policy is established and accepted by the public and local governing bodies, then workable guidelines and planning can follow, and the states could be expected to do most of the planning and decision making." *

Regional

There are two sorts of regional organizations, one intrastate and the other interstate. Each has its problems and unique applications, the former being built usually about a unique feature or situation (for example, San Francisco Bay), the latter about regional needs that transcend State boundaries (for example, the New England River Basins Commission). In both cases, however, multiple jurisdictions must be welded into a single ad hoc jurisdiction or district for some specified purpose. And in both cases active citizen initiative and broad public interest are probably crucial, since State action is required if the regional body is to have regulatory authority.

Referring to the San Francisco Bay Project, "The experience," says a recent Conservation Foundation Publication **

"provided many lessons to those who seek to protect other estuaries and other national resources, even if there is no pattered, ideal way to achieve environmental protection that will work everywhere. 'Much more important are the personalities and the quality of local politics.' . . . In other areas, other political arrangements may be needed. Several states might be involved in a resource. A compact, or a full regional government might be desirable. But it is worth reviewing the major ingredients of the San Francisco Bay story—because each of them *may* have been indispensable there and could be crucial elsewhere: A resource that was highly valued . . . rising environmental concern . . . factual basis . . . nucleus of concerned, hard-working citizens . . . legislators to take up the cause . . . campaign for legislation . . . coverage, from the press . . . an agency

* "Coastal Zone Management Problems—The State's Position," prepared for presentation to NACOA by Lyle S. St Amant, Louisiana Wildlife and Fisheries Commission, New Orleans, La.

** "The Saving of San Francisco Bay," Conservation Foundation, Washington, D.C., 1972.

which provides a forum for all the interested governmental jurisdictions and other parties to work out their problems together . . . non-nonsense staff and a respected, diplomatic chairman . . . public hearings and public debate . . . power to control uses of the resource it seeks to protect . . . Finally, of course, a plan and a law . . . that is enforceable . . . respected, and that draws wide support from the community."

The bite in the San Francisco Bay Group could very well have been its regulatory power. This is somewhat unusual at either intrastate or interstate levels such as, for example, the New England River Basins Commission. Although the NERBC has been influential and effective in a number of specific instances, it has authority only for planning. Formal interstate compacts may be increasingly desirable as management needs, which cross State boundaries, multiply in number and severity.

IMPLICATIONS AT THE FEDERAL LEVEL

We wish to emphasize that the *management* aspects of the coastal zone take on greater significance than is usual where an intimate mix of technical and scientific work is required.

NACOA believes that only by proper management can one get a handhold for progress in the coastal zone, that the powers vested in the States make their role pivotal, that the lead-agency concept for Federal involvement must be used, and that scientific and technical support must be made available and responsive to all levels of authority.

- Proper management is the key to progress in meeting and overcoming difficult problems in the coastal zone and in learning to anticipate them.
- Technical and scientific knowledge, without which proper management would be impossible, can be encouraged to serve the needs of that management.
- Management is in turn subordinate and in service to the local region—the coastal State—and derives a large part of its technical problems, goals, and force of implementation from the locality.

NACOA therefore advocates a National Coastal Zone Program whose two principal elements are Management (planning, legislation, development of regulations and standards, monitoring, and enforcement) and Research and Development (basic and applied research, engineering development, technical assistance, and advisory service). In order to make certain that the necessary collaboration between these two major elements is ingrained in the structure of the national program on the coastal zone, NACOA further urges that the research and development, as well as the management elements, be tied closely to existing geographic and political jurisdictions.

The summary of views held by various levels in the jurisdictional hierarchy indicates that they are looking for Federal action to provide

a number of vital elements now missing in a satisfactory coastal zone management system. Among the more important of these are:

- the articulation of national policy regarding the management of the coastal zone, and an effective means of governmentwide coordination in its implementation;
- the identification of nationally significant coastal zone areas, the specification of uses suitable for these areas, and initiative, including purchase, to assure appropriate development;
- for the remaining areas, the establishment of standards, criteria, and priorities of use within which lower levels of government can act on their own initiative;
- protection or compensation for private property owners against costs disproportionate to benefits;
- regulatory procedures, including procedures for appeal, that are uniform, reasonable, direct, and centralized;
- the provision, through support of appropriate research and services programs and institutions, of accessible, responsible, and competent technical expertise available to all levels of decision makers.

Since 1965, the major studies on ocean affairs, particularly the Stratton Commission Report, emphasized the importance of a prompt attack on coastal zone problems. Many of these recommendations are apparent in the U.S. oceanographic program today. A particular example is the Sea Grant Program supporting several institutions which are developing a capability to assist State and local governments in technical aspects of coastal problems. Basic legislation in coastal zone management is overdue both at the State and national levels. Some forward-looking states have made considerable progress in the areas, but the Federal Government is lagging badly.

RECOMMENDATIONS

In this chapter NACOA has discussed the basic elements that national coastal zone legislation should encompass and encourage.

The Senate has unanimously passed the Magnuson Coastal Zone Management Act—S. 3507, introduced by Senator Hollings—which largely satisfied the requirements we have put forward. A similar bill—H.R. 14146—has been introduced by Representative Lennon in the House. NACOA strongly recommends the passage and enactment of one of these bills.

There are competing legislative proposals which would have the effect of absorbing coastal zone management into a much larger national land use program (H.R. 7211 and S. 992). We do not support this approach for a number of important reasons: (1) The problems of the coastal zone have been very well defined by the work of earlier national and

State commissions. In the much larger land-use bill, the urgency would be diffused in the enormous variety and complexity of both physical and social problems that the larger act involves. (2) The technical problems, including the biological aspects, are sufficiently distinct that there could be no net gain, and almost certainly a loss, by mingling marine-oriented technology with land-use technologies. (3) The logical place in the Federal Government for a land-use program is the Department of the Interior. By contrast the governmental reorganizations of the last 7 years have placed most of the expertise in coastal zone affairs in Department of Commerce, in the National Oceanic and Atmospheric Administration. Further, other agencies that have expertise in this area, such as the Corps of Engineers, have strong links to NOAA.

We consider S. 3507 and H.R. 14146 progressive in the sense that they match very closely the developments of many of the coastal states, who are moving toward separate coastal zone programs of their own. H.R. 7211 is regressive in this respect. The movement towards separate management of the coastal zone is clearly supported by the National Governors' Conference, which for 3 successive years has strongly endorsed national coastal zone legislation. The same movement has been supported on the parliamentary level: *viz*, in the National Legislative Conference.

The Committee feels very strongly that there should be strong coupling between the information-gathering and the management functions. The legislation that we support does not do so explicitly; however, the fact that the Department of Commerce, with NOAA, would have the primary Federal responsibility for implementation of this program (under S. 3507 and H.R. 14146) assures the opportunity of this coupling. H.R. 7211 creating a land-use program centered in the Department of the Interior would impede achievement of this desirable goal. The legislation we favor does provide that the Secretary of Commerce will prepare rules and regulations which State coastal zone management plans must meet. NACOA observes that the Secretary, with the expertise available to him through NOAA, is in a position to recognize the necessity for close coupling of the information-gathering and the management functions in formulating these rules and regulations and to monitor state activities to see that this coupling actually occurs. Indeed NACOA is specifically charged with oversight of these issues and intends to make further recommendations in the future.

Moving Ahead

This first NACOA report is a beginning. It begins to examine the spectrum of critical national needs and priorities in the light of our Nation's role in man's stewardship of the oceans and atmosphere.

These are not abstract, remote problems for a few experts to worry about. They are basic to this country's well-being and perhaps even to its survival. It is already very late. In some places the oceans, coastal waters, and atmosphere have been degraded and their resources despoiled. In a few areas, we are close to the peril point and little time is left to turn matters around.

The preceding chapters provide NACOA's assessment of how things now stand with respect to our interface with other members of the world family, our fisheries resources, weather modification, and the condition of our coastal zones. We are not in good shape in many of these areas, and we are not moving rapidly enough or confidently enough to put our affairs in order. Each of the preceding chapters sets out the condition in which NACOA finds us, and the priorities as NACOA perceives them.

How did we get in this shape? What failings allowed us to arrive at situations tending toward irreversibility? What should we do to correct the failings?

National policy is the sum of governmental and private decisions and actions. Neither government nor private parties have been sufficiently alert to the emerging problems, nor prepared to make the adjustments and sacrifices necessary to deal with them.

The machinery for national policy making for marine and atmospheric affairs has been, and remains, weak and disunited. Responsibility and accountability are divided. Coordination is inadequate. Priorities are slow to emerge, decisions even slower, and resources to implement these priorities are too little and too late.

The problems addressed in this first NACOA report all show a common pattern: they arise from the behavior of a system that takes action

only in a crisis. Man's increased power to exploit the environment, and to destroy it, has brought an end to the era in which societal decisions could be based on a frontier philosophy. We no longer deal with unlimited resources of energy and materials. The shoreline is not unlimited. Species can be made extinct by over-zealous exploitation. Once we could fire a pistol that sent the settlers rushing to fill the vacant lands. Today, the ocean frontage is overcrowded, the pioneers have no new lands to conquer, but we still make decisions as though they did.

The established procedures for determining social actions do not reflect the new realities; and the deficiencies can often be traced to a failure to use available knowledge. The system should therefore address the need to keep information about the *realities* of our environment ever before the decision makers, be they legislators, city managers, governmental executives and, ultimately, our citizens. The system should also guarantee that those who gather data about the environment do so to support the informational needs of decision makers. The results of decision making should square with the realities; data gathering should be responsive to needs.

Each system for decision making should incorporate a system of checks and balances, permitting decision makers the opportunity to influence those who develop the information, and to give those who develop the information an opportunity to review and influence the decision making. Any system which does not display the characteristics of candor and consistency necessary to popular support will not be effective.

The pattern that should be adopted is clear. Its absence can be discerned as a reason for failure of existing attempts to reconcile competitive uses of common resources. This pattern emerges from the common sense observation that you cannot manage something you do not comprehend and you do not appreciate what you need to know until you try to manage something.

Some of the decision problems are highly decentralized, such as shoreline protection and development or estuarine development and conservation. Others are highly centralized, as is the case with Law of the Sea negotiations or severe storm modifications. But each resource problem, at whatever level, requires the close integration of fact finding and evaluation of alternatives.

To guarantee that these processes are carried out with integrity, it is necessary to provide for the generation of national policies. These policies should define the national interests and should provide guidelines for the resolution of conflicts which arise in pursuit of these policies. To make these points explicit, NACOA strongly urges that:

- legislation establish, in every case, both a focus of policy responsibility and a center for assembling the information upon which decisions can be made—and explicit provisions to see to it that these interact with each other;

- a strong policy-level office be maintained, reporting to the President and with outreach to state governments and private interests to focus and coordinate national policies, priorities, and implementation;
- the Administration and the Congress reopen the unfinished business of the Stratton Commission with respect to the structure, organization, roles, and missions of NOAA and other primary agencies charged with responsibilities for the oceans and atmosphere. The present arrangements, while a distinct improvement over the conditions which preceded the Stratton Report, still fall short of providing the fully integrated and accountable management system that is required. Scattered and divided responsibility is unlikely to produce the perspectives and decisions needed for arriving at goals and priorities for the oceans, the atmosphere, and the coastal zone. NACOA itself intends to address these issues in the coming months.
- an integrated annual budget and legislative program related to priority objectives of national oceanographic and atmospheric policy should be formulated and adopted by the President and the Congress at levels of effort commensurate with the critical problems confronting the Nation.

Absent these measures, serious discontinuities in policy planning, resource allocation, and policy execution will continue to bog us down in half measures and compromises. We can do better than that.



THE SECRETARY OF COMMERCE
Washington, D.C. 20230

September 27, 1972

The President
President of the Senate
Speaker of the House of Representatives

Sirs:

I have the honor to submit, in accordance with Public Law 92-125, August 16, 1971, the First Annual Report of the National Advisory Committee on Oceans and Atmosphere (NACOA).

Enclosed also are my comments and recommendations which are required by the Act.

Respectfully,

A handwritten signature in cursive script, reading "Peter G. Peterson".

Secretary of Commerce

Enclosures

COMMENTS AND RECOMMENDATIONS OF THE SECRETARY OF COMMERCE ON THE FIRST ANNUAL REPORT OF THE NATIONAL ADVISORY COMMITTEE ON OCEANS AND ATMOSPHERE

PREFACE

Public Law 92-125, which established the National Advisory Committee on Oceans and Atmosphere requires that the annual report of the Committee "shall be submitted to the Secretary of Commerce who shall within 90 days after receipt thereof transmit copies to the President and to the Congress with his comments and recommendations." Accordingly, the following comments are submitted. The comments have been organized to parallel the presentation in the Committee report and under the same chapter headings.

INTRODUCTION

The First Annual Report of the National Advisory Committee on Oceans and Atmosphere (NACOA) has focused on four critical oceanic and atmospheric issues confronting our Nation—the Law of the Sea, the Rehabilitation of our Fisheries, Weather Modification, and Coastal Zone Management. The findings and recommendations of the Committee warrant thoughtful consideration as new policies and programs are formulated and implemented. They provide a basis for further discussion on some of the key economic and environmental issues facing the Nation and a basis for immediate action on others.

The issues are complex. The way in which they are resolved will have an impact on the future economic and social welfare of the United States. The outcome of present international deliberations within the United Nations on the Law of the Sea

will determine the extent and character of the rights and obligations of our Nation and its citizens in the sea and its resources. The effectiveness of our plans to revitalize our national fisheries will determine whether our fishing industry can survive economically. What is perhaps more significant, it will determine whether the fishery resources off our coasts can be maintained in a healthy biological condition so that they may be harvested in perpetuity for the benefit of our and future generations. How we choose to manage our coastal zones will determine whether we can, in the long run, provide for protection of this environment while using it wisely to sustain the Nation's continued economic and industrial growth. The issues of weather modification go directly to the question of whether and to what extent we will develop and use new technology to manipulate environmental processes in the public interest. More importantly, it raises the question of the nature of the public interest. All of these issues raise basic philosophical as well as practical questions.

I am pleased that the Committee has recognized the important contribution that a strong United States merchant marine can make to our Nation's overall well-being and the impact of President Nixon's actions to revitalize our merchant fleet. Instrumental in this regard was the passage of the President's Merchant Marine Act of 1970 and the efforts of the Maritime Administration in the Department of Commerce to rebuild our maritime transportation system. I have requested the Assistant Secretary of Commerce for Maritime Affairs to consult with NACOA with respect to its comments and suggestions supporting a strong U. S. Merchant Marine.

For many of the findings and recommendations of NACOA, policies and programs are presently under study and the views of NACOA are welcomed as valuable contributions in their formulation. For others, planning is underway or action is being taken to implement committee recommendations. For a few, the views of the Administration are at variance with those of NACOA.

I believe that my comments on the NACOA report can best serve the intent of Public Law 92-125 by addressing only key policy issues to indicate where the Administration is moving to carry out the recommendations of NACOA and to present the rationale of the Administration where its plans, programs, and policies differ from those recommended by NACOA.

SOME INTERNATIONAL ISSUES RELATED TO THE LAW OF THE SEA

I concur with recommendations of NACOA for actions which can strengthen the United States position in international ocean affairs by joining with other countries, particularly developing countries, in joint projects. Many Federal Agencies including the National Science Foundation and the National Oceanic and Atmospheric Administration (NOAA) are engaged in a wide spectrum of joint efforts, both with developing and developed nations. A number of countries now participate actively with the United States in ocean projects. Some of the innovative suggestions for additional cooperative ventures will be explored. At the same time, I must note that the NACOA report does not fully reflect either the carefully defined policy which the United States has followed in the current Law of the Sea negotiations, based on the President's statement on United States oceans policy of May 23, 1970, or the institutional arrangements created to implement that policy.

In 1970 an Interagency Law of the Sea Task Force was established under the chairmanship of the legal adviser of the Department of State. From its inception, the Task Force has been composed of representatives of all agencies within the Executive Branch concerned with the proposed 1973 Law of the Sea Conference. The primary responsibility of the Task Force is to elaborate on United States oceans policy within the guidelines established by the President. Its recommendations are reviewed by the Departments concerned and, where appropriate, in the Executive Office.

Since early 1972, the Task Force has been assisted by an Advisory Committee on the Law of the Sea, composed of about sixty representatives of the business, professional, academic and scientific communities. The Advisory Committee has already made a valuable contribution to the formulation and negotiation of United States oceans policy, and its advice will become even more important as the Law of the Sea Conference approaches.

The fundamental problems facing the United States in the Law of the Sea forum concern the respective rights of nations to use the seas and their resources. The issue, as the President stated, concerns whether the oceans will be used rationally and equitably for the benefit of mankind or whether they will become an arena of unrestrained exploitation and conflicting jurisdictional claims.

The present state of the Law of the Sea is inadequate to meet the needs of modern technology and the concerns of the international community. If not modernized multilaterally, unilateral action and international conflict are inevitable. At stake are the maintenance of order in the oceans, protection of national security and economic interests in free navigation and overflight, assurance of supplies of energy and minerals from the seabeds and fisheries from the sea, maintenance of maximum freedom of scientific research, and protection of the marine environment.

The President's statement on United States oceans policy of May 23, 1970, sets out certain objectives which the United States Delegation of the United Nations Seabed Committee has been seeking to achieve for over two years, primarily through a number of specific proposals submitted to that Committee. They include:

- ◀ A draft convention on the resources of the seabed which provided a 200-meter depth limit of national jurisdiction over the seabed, an intermediate zone of mixed coastal state and international jurisdiction embracing the continental margin, international machinery to administer exploitation of seabed resources in the area beyond national jurisdiction, and sharing of benefits with developing countries.
- ◀ Draft treaty articles which would fix the breadth of the territorial sea at 12 miles and guarantee a right of free transit through and over international straits.
- ◀ Draft treaty articles providing for a system of preferential rights of coastal states in high seas fisheries adjacent to their coasts.

The United States is also taking an active role in the Law of the Sea negotiations on the subjects of marine pollution and marine scientific research and has proposed draft treaty articles drawing on the relevant conclusions of the Stockholm Conference on Human Environment.

REHABILITATION OF UNITED STATES FISHERIES

I share with the NACOA the sense of concern in rehabilitating United States fisheries. It is United States policy to bring this traditional American industry back to economic health. The Committee's views are helpful in outlining the basic problems which must be overcome to achieve this goal.

I find it reassuring that many of the Committee's recommendations support fisheries policies which we have instituted since the creation of NOAA. The Committee rightly points out that a new situation now confronts the world's fisheries . . . that there is a basic threat to the world's fishery resources from growing fishing pressure by all nations.

NACOA calls for a basic approach to fisheries management which is resource-oriented. With this view we concur wholeheartedly, and we are moving both domestically and internationally to invoke such an approach:

This Administration is pressing internationally, within the context of the Law of the Sea, to establish standards of fisheries management which are directed at the worldwide conservation of fisheries resources so they may be harvested at a sustained yield that will preserve all stocks as a perpetual source of food and recreational enjoyment. We have strongly advanced as a management concept the assignment to coastal nations of the management responsibility for coastal species and anadromous stocks and to international bodies for highly migratory species.

In the interim, to the extent that international realities permit, we are seeking to increase the management effectiveness of the many international Fisheries Commissions. Already, our policies are having some effect. In the International Commission for the North Atlantic Fisheries, we have urged, and the Commission has adopted, "country" quotas for some ten different stocks of fish.

Although not of the same commercial importance, we have been moving vigorously as a matter of national policy to protect marine mammals and restore them to ecological health, through the International Whaling Commission and the North Pacific Fur Seal Commission.

While there has been some progress, we cannot be satisfied with the present status. We will continue to press for better management and better conservation in all international forums until our national objectives are achieved.

Domestically, we have introduced new programs within the last two years to attack other key problems identified by the Committee. The Department of Commerce has taken the initiative to launch its Marine Resources Assessment and Prediction Program. This effort is aimed at achieving one of the Committee's key recommended actions . . . to provide for systematic knowledge of all the fishery resources of importance to the United States. Secondly,

the Department of Commerce is moving ahead to engage the several coastal states in a resource-oriented cooperative State/Federal fisheries management program.

It is steps such as these that NACOA says will provide the proper environment for basic inducements for investment and venture, and we agree.

The Committee suggests that national planning for rehabilitation of our fisheries should be based on a set of specific goals. They feel that only then can programs for achieving such goals be instituted. They do not minimize the difficulties of either setting such national goals or developing the plans for achieving them. We agree the matter is not simple. NACOA suggests that the basic national fisheries goal be set in terms of a specific percentage of the share of the domestic market to be supplied by our domestic fisheries. They recommend, as a goal, increasing the present share of the Nation's fisheries needs supplied by domestic industry from 30% to 40% . . . an increase in the domestic catch from 2.5 billion to 3.5 billion pounds of fish annually.

Such a goal would reduce our dependence on foreign sources, reduce significantly our present billion-dollar trade deficit in fisheries products, and increase employment in a rejuvenated industry. Such an increase in our domestic industry is to take place against a backdrop of a rational fisheries management system.

I believe that the implications and consequences of such a fisheries goal should be explored fully before it is set as a national target, so that we can understand the costs involved and other policy implications, such as effects on domestic fish prices to the consumer and effects on tariff and trade policy.

WEATHER MODIFICATION

I believe that NACOA has correctly assessed the exciting outlook in the field of weather modification. There is no question that developments of the last decade have put us on the threshold of weather control. To realize the potential of this new technology, the Committee urges action in the field of legislation, research and technology, hurricane control, public policy and international relations.

I welcome both the Committee's analysis of the present status of weather modification technology and its many recommendations for action. The present national plans for development of this

field closely follow many of the suggestions of the Committee. The public policy positions, especially as they relate to the international aspects of weather modification and our posture in this field, are being studied by the Administration. The Committee's views on these matters will be considered in the course of these studies.

The need for Federal legislation to define the rights and responsibilities of citizens, States, and the Federal Government; to establish regulatory mechanisms and liability provisions; and to protect the public is strongly supported by NACOA. Along these lines this Administration recommended legislation that has been enacted requiring the reporting of all weather modification activity to the Secretary of Commerce. I welcome the views of the Committee concerning the need for further legislation.

The analysis of national needs for research and technology in weather modification is a balanced and comprehensive treatment. The findings and recommendations offer a sound basis for further development of the national effort.

The review of the technical obstacles to progress in this field provides a framework for organizing our scientific effort, directed at understanding critical physical processes, and for our technological development effort in instrumentation and facilities. The call of the Committee for an expanded field effort in the Great Plains region of the United States is welcomed, and initial plans for such an effort are being prepared.

Some concern has been expressed by NACOA about the fragmentation of effort among the many agencies of the Federal Government, and NACOA recommends that a single Federal Agency take the lead in the development of the technology of weather modification. I agree with this recommendation for establishment of a central focus within the United States Government for carrying out research and development in all phases of weather modification. However, I believe that weather modification technology should remain available for use by all agencies of the Federal Government in the discharge of their mission responsibilities. It would also be unwise to divorce the necessary supporting research that would be required for the application of weather modification techniques from the agency with responsibility for such application.

The Committee has given special attention to the national effort in hurricane modification. I agree that this effort represents one

that must be fostered at an accelerated pace. I welcome the views of NACOA on this issue, as we develop our plans for this effort.

The Committee's concern for the public policy issues is deeply appreciated. Weather modification carries with it the potential for social gain, but not without the threat of concomitant social losses. It is clear that careful technological assessments of the consequences of the application of weather modification are required before decisions for widespread use are made. There is no question that we do not know enough at the present about many of the public policy issues involved, and they require continuing study. Studies are already being sponsored by the National Science Foundation and NOAA.

The realization that weather modification has critical international implications is strongly emphasized by NACOA. The Administration is conscious of these implications and welcomes NACOA's views on these matters. It is the policy of this Administration to foster international collaboration in this field to the maximum extent possible. We are moving to follow up the recommendations of the United Nations Conference on the Human Environment held in Stockholm this year for the monitoring and study of inadvertent weather modification in cooperation with other nations. We are working closely with all nations of the world on the World Weather Program and its research phase, the Global Atmospheric Research Program. We are continuing our exchanges of scientists with the Soviet Union and other countries in many phases of weather modification, and are extending assistance to developing countries in those instances where weather modification appears to be a useful tool in ameliorating weather-related problems.

COASTAL ZONE MANAGEMENT

The issue of coastal zone management arises from the rapidly increasing demands for use of the coastal zone, many of which are highly conflicting. For example, industrial and commercial usage of shorelands may be incompatible with recreational demands or the demands of fishery and wildlife conservation. This kind of incompatibility and the need to provide for all of our national needs generate the pressing need for management decision at all levels of government on the uses of our shorelands.

NACOA points out that the problems are complex, and there exists a need for a National Coastal Zone Program which will address both the management and scientific and technical problems upon whose solution rational management decisions depend. I join with the Committee in recognizing the urgency of our coastal zone problems. In the Department of Commerce, we have initiated programs to illuminate the scientific and technical problems which the Committee has assigned such high priority. Our program in marine ecosystems analysis is undertaking comprehensive scientific and technical studies of key regions of our coastal waters to provide necessary scientific and technical data for coastal zone planning. Similarly, we have joined with Canada in the International Field Year of the Great Lakes in the most comprehensive study of lake conditions, and we have not neglected the more difficult economic, social and legal problems of coastal zone management. The Department's Sea Grant Program has been focusing increasing attention on these problems.

I therefore welcome the substantive recommendations of NACOA and agree that action on them requires serious consideration. I also agree with the Committee that early passage of necessary legislation to provide for a coastal zone management system is necessary. The recognition of the national need for a coastal zone program has been widespread. The action of the Senate in the unanimous passage of the Coastal Zone Management Bill signals its great concern for action in this area. The action of the House in the passage of a parallel bill indicates a similar view.

The Administration has moved to take action with respect to coastal zone problems. It has given it a high priority as part of its Land-Use Policy proposals. There has, however, been a difference of opinion regarding the proper administering agency for the coastal zone management program. NACOA recommends the passage and enactment of a bill which would put the responsibility for coastal zone management in the Department of Commerce. The Committee feels that there should be a strong coupling between the technical expertise which resides in the Department of Commerce, National Oceanic and Atmospheric Administration, and the management function. The Administration believes that coastal zone management cannot be separated functionally or as a matter of program management from overall land-use management. However, recognizing the importance of the marine ecosystem and the competence of NOAA in this field, the Administration believes

that all decisions affecting such marine matters should require the concurrence of the Department of Commerce.

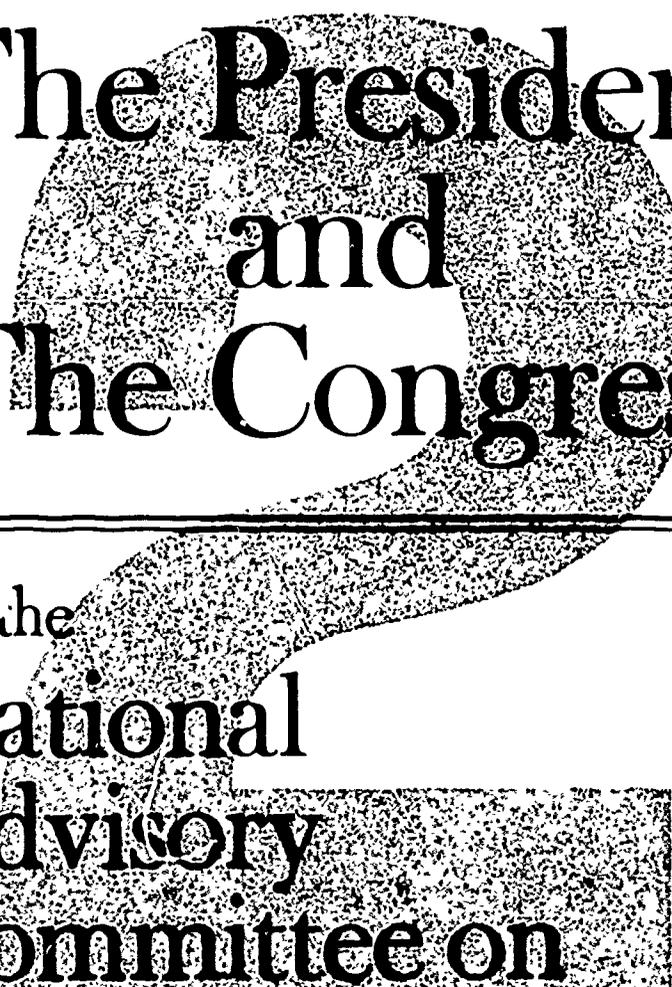
Certainly, there is room for debate in such problems of assigning jurisdiction. However, the Administration believes that its solution will protect and enhance the vital marine considerations.

MOVING AHEAD

I was much interested in the assessment by NACOA of the machinery for making oceanic and atmospheric policy. It is a problem that has deeply concerned the President, not only in the field of oceanic and atmospheric affairs, but in all governmental affairs. It was the President's concern for such matters that led him to take vigorous action in environmental matters in establishing the Council on Environmental Quality, the Environmental Protection Agency, and the National Oceanic and Atmospheric Administration. It was this same concern that led to the President's sweeping proposals for reorganizing the Executive Branch of Government, which would establish the Department of Natural Resources. The Administration welcomes the suggestions of NACOA on ways of improving the national policy-making machinery. It feels that many of the weaknesses inherent in the present organizational arrangements would be remedied by the President's reorganization proposals.

However, at many points in the Committee report, attention has been called to the need for effective mechanisms for coordination between the activities of the many Federal Agencies to insure a coherent national program in both oceanic and atmospheric affairs. The impression is conveyed that no such mechanisms exist. I feel that it should be noted that many mechanisms do exist, although they do suffer from imperfections. Under the Federal Council for Science and Technology, chaired by the President's Science Adviser, and its subsidiary committees, there has been established a Government-wide mechanism for coordination of scientific and technological matters. In particular, in the fields addressed by the Committee, there exist an Interagency Committee for Atmospheric Science and an Interagency Committee for Marine Science and Engineering, which undertake annual reviews of the total Federal effort in these fields, address policy questions, and coordinate agency programs.

A Report to:



The President
and
The Congress

by the
National
Advisory
Committee on
Oceans and
Atmosphere

Washington, D.C.

Second Annual Report

June 29, 1973

NATIONAL ADVISORY COMMITTEE ON OCEANS AND ATMOSPHERE

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 Arthur Godfrey Productions

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 Dean of Earth and Mineral Sciences
 Pennsylvania State University

*** Resigned on becoming Assistant Secretary of Commerce for Science and Technology.**

Executive Director: Douglas L. Brooks

Staff Assistant: David A. Katcher

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Supporting Staff: Elizabeth S. Tune (Administrative Aide), A. Anne Davis, Agnes O. Eley, Florence E. Thomas



**NATIONAL ADVISORY COMMITTEE
ON
OCEANS AND ATMOSPHERE**
Washington, D.C. 20230

To the President and the Congress:

Sirs:

I have the honor to submit to you the second Annual Report of the National Advisory Committee on Oceans and Atmosphere.

The Committee was established by P.L. 92-125, approved on August 16, 1971, and was directed to submit a comprehensive annual report to the President and to the Congress setting forth an overall assessment of the status of the Nation's marine and atmospheric activities.

This report is submitted to the Secretary of Commerce for transmittal as provided by the statute.

Respectfully,

William A. Nierenberg
William A. Nierenberg
Chairman

June 29, 1973

FOREWORD

In this, its second Annual Report, the National Advisory Committee on Oceans and Atmosphere (NACOA) comments on a number of fast-moving if somewhat disputatious topics: resource management organization, energy, the coastal zone, atmospheric affairs, and fisheries.

NACOA was chartered by P.L. 92-125 to report, both to the President and to the Congress, on national marine and atmospheric affairs, and to the Secretary of Commerce with respect to the National Oceanic and Atmospheric Administration (NOAA). It reports this year, as it did last, by treating a series of priority topics where it can do so with assurance. The intent is to deal with the leading edges of marine and atmospheric affairs rather than to review the whole array of programs. And, once again, there were several fundamental and pressing issues which NACOA wanted to include but did not, largely because preparation could not be adequate.

The theme of this report—which we treat in more detail in the Introduction—is the need for improved management of programs in both the oceans and the atmosphere to counter the dispersive tendencies which seem to be occurring in the shadow of jurisdictional frictions and in the absence of resource leadership. While NACOA be-

believes there is no single way to accomplish this, it does offer suggestions and recommendations, both general and specific, by which improvements could take place.

SUMMARY OF RECOMMENDATIONS

NACOA FINDS the impact of budget cutbacks on oceanic and atmospheric programs distorts national priorities in these areas largely because of organizational fragmentation and the lack of a strong management focus at a sufficiently high level in government. NACOA therefore RECOMMENDS that:

To obtain the best use of our oceanic and atmospheric resources, responsibility for their management should be given a central focus, and their management, along with that for other natural resources, should be reorganized into a single Federal agency at the departmental level.

NACOA FINDS that in balancing environmental costs against need for energy, the oceans must play an increasingly significant role during the difficult transition from national reliance on domestic terrestrial fuel to substantial use of energy from offshore oil and gas, from foreign oil and gas, and from nonconventional sources. NACOA therefore RECOMMENDS that:

Intensified exploration and drilling effort be undertaken offshore; that single-purpose single-point mooring deep-water oil terminals for landing foreign oil imports are generally preferable to multiple-use superports; and that such terminals should be operational in the Gulf by 1976 and off the East Coast by 1978. NACOA further RECOMMENDS that the offshore and coastal development for powerplant siting be seriously considered where the extraordinary capacity of the ocean for waste-heat absorption can be safely used.

NACOA FINDS that the penalty for delay in funding the Coastal Zone Management Legislation enacted last fall has been lack of action in some states and uncoordinated action in others. NACOA therefore RECOMMENDS that:

The National Coastal Zone Management Act of 1972 (P.L. 92-583) be funded to the full amount authorized by law and its implementation in all aspects vigorously pursued.

NACOA FINDS that it is now time to take advantage of the successes

in understanding large-scale atmospheric behaviour and to emphasize applying this knowledge, together with small-scale information, to deliver better forecasts and warnings. NACOA therefore RECOMMENDS that:

Increased priority be placed on smaller-scale meteorological phenomena, on disseminating routine local forecasts, and on monitoring public response to weather forecasts and warnings.

NACOA FINDS that, although we appear to stand on the threshold of practical weather modification, and some facets are operational, in other applications a great deal of complex research still needs to be done. Unless the scientific manpower and funding are better directed, we assuredly will continue to make very slow progress towards weather control. NACOA therefore reiterates its RECOMMENDATIONS of last year that:

The many small programs in weather modification now scattered widely through the Federal agencies be focused and coordinated under NOAA's lead; basic cloud physics and dynamics be given higher priority; and that the legal, social, and economic impact of weather modification be thoroughly examined and appropriate regulatory and licensing legislation be sought.

NACOA FINDS to its distress that national objectives for U.S. domestic and international fisheries are in disarray. NACOA therefore RECOMMENDS:

Passage of High Seas Fisheries Bills such as HR 4760 and S 1069; development of a national plan for use of the national fishery resources by the Secretaries of Commerce and Interior; that international agreements incorporate effective mechanisms for conservation and greater awareness of the problem of uniform international enforcement; and continued support of the species approach in the coming Law of the Sea Conference.

NACOA OBSERVES that the Federal Budget crisis is less severe than it appeared to be in January. NACOA therefore strongly URGES that:

The President direct a reconsideration of high priority needs in ocean and atmospheric affairs as part of the 1975 budget review and restoration of selected reductions and postponements.

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Introduction

Fragmentation *vs.* focus, fire-fighting *vs.* planning—these were the issues which this year turned NACOA inward and away from the international aspects of oceanic and atmospheric affairs it dealt with in last year's Annual Report. The theme which runs through most sections of this Report is about organization for the management of marine and atmospheric affairs and what the lack of such organization does in certain critical areas.

The impact of the budget cutbacks and restraints on oceanic and atmospheric programs has been subtle rather than abrupt, but it has had a distorting effect on programs and has resulted, in some instances, in a reduction of services which NACOA feels are important to the national interest. Momentum is being lost. We face the future with less assurance than we did last year at this time. NACOA notes, in not one place but in several, a dispersal of management and a withdrawal of support from important long-range centralized endeavours which could result in trouble down the road.

NACOA feels that this fragmentation, and this withdrawal of support from some long-range programs and their facilities, may have occurred because a natural sponsorship for resource management—the oceans and the atmosphere *are* resources—does not exist. The old backing is weakening, for oceanic affairs especially, as missions and problems change and budgets go flat or down. Nothing is taking its place even though the national need in ocean affairs grows larger.

For this reason NACOA deals with organizing, in the development and conservation of natural resources, for the better management of the Nation's oceanic and atmospheric endeavours. The generalities and suggestions for a functional arrangement are made in the first chapter. Some specific cases and arguments are in succeeding chapters:

- Lack of sponsorship may slow or warp the rational development of offshore energy resources with its delicate balance between essential

and necessary exploitation and the critical requirement of environmental protection. (See Chapter on Energy and the Oceans.)

- Complications in sponsorship resulted in lack of action in funding the Coastal Zone Management Act. A section of the Report examines what NACOA finds to be the high price of delay. (See Chapter on Managing the Coastal Zone.)
- Divided sponsorship has had a deleterious effect in some important atmospheric matters. There has been little progress toward the institution of controls of weather modification and investigation of its indirect societal effects. The experimentation in weather modification has itself had its leadership fragmented rather than consolidated. (See Chapter on Atmospheric Activities.)
- Disappearing sponsorship for the vessels, instrumentation, central facilities, and networks which brought physical oceanography to its present healthy state and marine geology and geophysics to a new epoch in exploring earth movement and change, means that the national preeminence in these areas will fade unless the trend is reversed. (We will enlarge on this point briefly below.)

We prepared, and will issue shortly, fairly lengthy discussions on marine geology and geophysics, and on physical oceanography. In both of these fields strong research programs are underway but there is reason to question whether this situation will last. In geophysics the status of the World Wide Standard Seismograph Network and its accompanying data services has not been completely settled at this writing; in oceanography, the oceanographic fleet has been cut by 25 percent.

Into this climate of arrested momentum comes a special research opportunity with implications in regard to natural disasters, energy resources, and the location of economic concentrations of mineral resources—the International Geodynamics Project. This project is an international program designed to gain better understanding of the dynamics and dynamic history of the earth in the light of the new concepts that have recently been developed concerning the origin of the earth's surface features. Over fifty countries are now participating. NACOA considers it in the national interest that there be a commitment by the government for U.S. participation both in assigned function and in specific support. The Geodynamics Project has a finite life—six years—and many other countries are looking to the U.S. for leadership. We have provided this in the past and should continue to do so in the future.

The reduction of the oceanographic fleet will have pervasive and long-felt effects. The oceans are a very poorly understood part of the world, remote and hard to get at. Men must go to sea to study them. While some observations can be made by remote sensing, as from satellites, there is no complete substitute for a platform from which one can read not only what

occurs at the surface, but at the depths below, on the sea bottom, and below that. Curtailing the opportunities to work at sea first hand is a major reversal of a long-sustained and highly fruitful policy by the leading sponsors of marine research, the Office of Naval Research and the National Science Foundation. Since historically the pace of this research has not kept up with man's use of the ocean, this cutback makes the gap grow larger. The increased and very welcome interest of atmospheric scientists in probing the effects of the sea on weather and climate add measurably to the demand for research. Thus it is by no means paradoxical that at the very time we can praise the current accomplishments of oceanographic work, we must express our concern for its future.

NACOA did not make its discussion of ocean research part of the Report. The issue of scattering rather than gathering the forces in oceanic and atmospheric matters enlarged to become central to the entire Report and details of ocean research are more technical than those of the examples we decided to use. But the principle is clear: *Underinvestment in the capital structure needed for marine and atmospheric research of the next decade could mean losing ground which would be costly to regain in later years.*

We also have made comment on the need for national planning for the U.S. fisheries, and for the necessary conditions of economic regulation and enforcement in addition to conservation and biological management. And we have called for an enlarged emphasis on small-scale weather forecasting and on better understanding of public response for improved dissemination of warning.

In our view, and for marine affairs especially, the theme of appropriate and undivided sponsorship needs application across the full range of the Nation's natural resources. We therefore urge greater centralization and more effective leadership of the Federal activities in natural resource management.

Natural Resources and Marine Affairs *

Marine and atmospheric resources offer problems in proper management which differ sufficiently from those on land to make it unwise to treat national activities offshore—or in the atmosphere—as mere extensions of what goes on on solid ground. On the other hand, management of our land, water, and atmospheric resources are so related and associated, so interactive, that to split them up organizationally is artificial, wasteful, and frustrates progress. In this chapter, NACOA deals with some of the difficulties generated by the currently fragmented treatment and suggests an organizational approach to correct it. NACOA's primary concern is that oceanic and atmospheric efforts maintain a focus which recognizes the unique and special characteristics of each.

NACOA finds that national management and organization of the Federal roles and missions concerning marine and atmospheric affairs is improving too slowly if, indeed, it is improving at all. There are too many actors, too many separate chains of command, too many crosscutting policies, too many separate budgets, appropriations, and programs. In this confusion, national priorities have no perspective and neither the Executive Branch nor the Congress is in a position to lead effectively, much less en-

* The organizational bond between the oceans and atmosphere, to which NACOA owes its existence, evolved in large part from the need to bring together the scientific research and observational activities going on because of the key role the oceans play in forming weather and in reflecting it. The users of atmospheric forecasts and other services are myriad, however, and no less terrestrial than they are marine, and include activities in the private sector as well as governmental. It is somewhat arbitrary, therefore, to locate atmospheric activities in one department rather than another. We include them in a department for natural resources because of the history of their relationship with the other activities, particularly marine. *We believe the present Federal organization for atmospheric affairs is generally excellent and should be preserved in any reorganization.* This is not the case with marine activities which are dispersed. Accordingly, we focus the systematic discussion in this chapter on the marine programs and deal with the atmospheric aspects only where they arise.

force accountability for results. Important leadtime has therefore already been lost and we are less able to deal with the problems of the '70s than we should be.

These problems include some of the most pressing and urgent of our times. Our domestic energy crisis cannot be resolved without, among other efforts, greatly expediting the development of our offshore oil and gas deposits. The dependence of many nations for food from the sea has encouraged multinational competition in fishing which is putting dangerous pressure on the world's fisheries. And not too far off there is the possibility of international competition for deep seabed minerals which could be unsettling.

These exploitive activities, engaged in by ourselves and others, increasingly threaten the marine and atmospheric environment. Since individuals generally cannot own portions of the sea and air, only government can regulate and coordinate the uses to which they are put in the interests of mutual compatibility and for the protection of the environment. The United States does not have the institutional capability to interact at this level on the necessary scale today.

The strength of our national economy is harder to sustain without healthy and productive marine resource development. In the face of an adverse trade balance, the near \$1 billion annual payments deficit due to fish imports merits greater attention. The rapidly rising price of oil and gas hurts the pocketbooks of consumers directly. Our great dependence on imports weakens the dollar abroad, contributing to inflation at home. The decline of the U.S. merchant marine and our growing dependence on foreign bottoms for shipping, long deplored from the viewpoint of national security, deserves also to be looked at from the point of view of the impact on our place in the world economy.

Since the demand for resources is independent of its origin, there is no question but that national policies, legislation, and public and private investment in marine and land resources—and their management—should be seen in a total, balanced perspective. What this means is that marine and land resources belong together in a single department, as has been proposed, and that an appropriate top level policy and planning activity taking the broadest possible view be established to provide a unified overall framework for national resource development.

At the level of program and policy *application*, which involves the explicit choice of development strategies, and at the level of regulatory administration, marine and terrestrial resources development move into very different contexts. Ocean resources development differs markedly from resource development in the continental interior in questions of ownership and law, environmental hazards, personal and environmental safety, and the requisite science and technology.

At this level, we recommend that the proposed department be assigned the bulk of Federal activities and expertise required to:

- develop policy, programs, and strategies for marine and atmospheric resource development within the broader framework of natural resource development objectives;
- exercise marine area multiple-use coordination and regulation; and
- acquire and apply necessary scientific and technological knowledge, engineering capability, and services.

We discuss the purposes to be served and organizational arrangements for their achievements in what follows.

A DEPARTMENT FOR NATURAL RESOURCES

The case for bringing “. . . together in one agency most of the primary responsibilities and functions required to assure the most effective achievement of natural resources and related environmental objectives” was well made in the publication, “Papers Relating to the President’s Departmental Reorganization Program.” * We agree that, “. . . since natural resources involve a coherent system of relationships among resources and with the environment, they need to be managed within a single organizational framework.” ** And we certainly agree with the analysis that population growth, urbanization, industrialization and expectations of rising standards of living are putting increasing pressure on resource after resource, here within the United States and around the world, and make the proposed reorganization urgent.

We feel that the analysis presented, however, is incomplete. It displays a near total preoccupation with the problems of managing terrestrial resources and environments with little attention to those in the coastal zone and in marine areas where resource-environment relationships are so markedly different. The numerous studies of governmental reorganization which it cites as forerunners of its recommendations begin with a report of a Joint Commission of Congress to President Harding recommending the transfer of non-military engineering activities of the War Department and the functions of the Federal Power Commission to the Department of the Interior. They include among the many citations the recommendations by both Hoover Commissions. The first presented in 1949 a minority view to consolidate water resources and public land management functions in a

* Office of Management and Budget, GPO, February 1972, p. 121. At the time of this writing, this is the only published document available to NACOA that develops in detail the basis for the Administration’s thinking on the new department. Although we are aware that several variations of the theme presented in the “Papers” are under current consideration, we are addressing the principles involved, and their application to marine and atmospheric affairs.

** *Op. cit.* p. 115.

Department of Natural Resources. The second Hoover Commission proposed in 1955 the creation of a Water Resources Board and assignment of the Soil Conservation function of constructing dams for flood control to the Corps of Engineers. Last mentioned is the June 1970 report to the President by the Public Land Law Review Commission recommending a Department of Natural Resources which would bring together the major public land agencies.

No reference, however, is made to any of the series of major studies and reports concerning marine resources and their management which had appeared during the last fifteen years. The series began with the 1958 National Academy of Sciences report, "Oceanography 1960-1970." It culminated in the Report of the Commission on Marine Science, Engineering and Resources, "Our Nation and the Sea," in 1969. The organizational and program content of what the Commission called the national program in marine and atmospheric affairs derived in part from several earlier studies by the Interagency Committee on Oceanography, particularly its 1963 report, "Oceanography, the Ten Year Ahead." Further development of these ideas took place in congressional hearings, especially those held by the Subcommittee on Oceanography of the House Merchant Marine and Fisheries Committee in 1965, and in the 1966 report, "Effective Use of the Sea" by the Panel on Oceanography of the President's Science Advisory Committee. The concept of a national program was given practical form and budgetary and programmatic meaning by the activities of the Cabinet-level National Council on Marine Resources and Engineering Development, established by Congress as an interim body in the Executive Office of the President and chaired by the Vice President. Its activities during the five years of its existence are reported in its annual reports, 1967 to 1971. These reports all testified to the meagerness and fragmentation of the national effort at sea, in the light of the prospective national need, and to the benefits to be found in more centralized management of Federal marine development efforts and the intimately linked atmospheric and oceanographic research programs.

The formation of the National Oceanic and Atmospheric Administration (NOAA) by Reorganization Plan #4 of 1970, is sometimes cited as solving Federal fragmentation in marine and atmospheric affairs. But, as noted in the "Papers" the formation of NOAA ". . . still left the related offshore oil, gas, and mineral resource, and earth sciences programs separately managed by Interior."* And this is far from the whole story. Interior also retained or has since been assigned programs with significant marine components in recreation (the Bureau of Outdoor Recreation, the National Park Service, the Bureau of Sport Fisheries and Wildlife), in water as a resource (the Office of Saline Water, the Office of Water Re-

* *Op. cit.* p. 117.

sources Research), in weather modification (the Bureau of Reclamation), and in coastal zone management (the Bureau of Land Management and the Office of Territorial Affairs). The U.S. Army Corps of Engineers and the U.S. Coast Guard also play very large roles in marine and coastal zone management, regulation, and public works. Highly significant roles are played by the Department of State, the Environmental Protection Agency, the Council on Environmental Quality, and, of course, NOAA. In marine and atmospheric science, general-purpose engineering development, and technical services we must include the Corps of Engineers, the Navy, the Maritime Administration, the Atomic Energy Commission, the National Aeronautics and Space Administration, the National Science Foundation, and the Smithsonian Institution, as well as Interior and NOAA.

To deal with this proliferation it has been necessary to create management devices such as coordinating committees, coordinators, and the like. The major ones are the Interagency Committee on Marine Science and Engineering (12 agencies represented), the Interdepartmental Committee for Atmospheric Sciences and the Federal Coordinator for Meteorological Services and Supporting Research (each with 13 agencies represented), and the Interdepartmental Committee for Marine Environmental Prediction (10 agencies represented).

But coordination is never enough. Coordination usually means *exchange* of information. Rarely does it involve table-pounding establishment of priorities, guidelines, and new policies to meet new problems. Especially when the budget gets tight, coordination is not by itself tough enough to protect multiagency programs. What happens is not so much that things get left out, though that happens, but that programs get distorted. Program cutbacks in one agency have side effects on others which change the overall program balance and priority without anyone really being responsible for what happened.

The distortion of some interagency programs is one of the key impacts of the FY '73, and FY '74 budget decisions in the affairs under NACOA surveillance. The effect, as is true of policies which result in underinvestment, is in the future, but it is nevertheless important. For example, the Coast Guard has been forced to abandon three ocean stations (as of June 30, 1973) and will have abandoned three more by mid-1974. The only remaining station will be *Hotel*, 200 miles off Delaware, which is occupied eight months of the year. But the ocean station's function of synoptic off-shore weather and ocean observation is becoming *more* rather than less important to seagoing activities. While instrumented satellites will help with weather observations, it will be at least a year, and perhaps several, before NOAA's ocean data buoy program can be deployed to even partially fill the gap. Plans for additional buoys to fulfill this need have been included in future budgets, but the funding is in serious doubt. What was a

least-harm cut to the Coast Guard activities was a far more serious one to an interagency program in the oceans and atmosphere which, in a certain sense, belonged to no one.

Another example, the Nation's oceanographic research fleet—whose academic component is properly the joint responsibility of the Office of Naval Research and the National Science Foundation, and whose government in-house component is partly NOAA's and partly the Navy's—is being reduced by about 25 percent in FY '74. This is at a time when a long-cultivated collaboration between oceanographers and meteorologists is just beginning to show results and joint programs with foreign scientists are beginning to materialize. Though we are assured by these agencies—after the fact of these budget cuts—that ways have been found to avoid any very evident immediate impact, we have also discovered that none has a very good idea of the future and any semblance of a national plan is totally lacking.

Looking Ahead

The apparent lack of attention to marine affairs in the analysis underlying the proposed Department of Natural Resources in the "Papers" is most striking when one looks ahead. New national needs for whose fulfillment the Federal Government must assume broad leadership responsibility are generating severe strains in the Federal establishment, and these strains will grow unless eased by major realignment of responsibility with authority.

Take, for example, developing the oil and gas deposits of the Outer Continental Shelf. The President has announced a goal of tripling the annual rate of offshore acreage leased by 1979, implying among other things: the need for strengthening operating standards and surveillance to reduce the likelihood of oil spills; the acquisition and dissemination of general purpose geophysical survey data; the provision of marine geodetic controls (particularly for lease demarcation); improved knowledge of marine climatology, surface conditions, engineering properties of the ocean bottom; and the establishment of safety standards. The Department of Interior, NOAA, the Environmental Protection Agency, the Corps of Engineers, the Coast Guard, the Council for Environmental Quality, the National Science Foundation, and the Navy are all involved in one or another aspect.

The need for imported oil generates a need for building new offshore facilities by 1980 collectively able to handle annually up to 500 million long tons of crude oil carried by tankers of up to 500,000 dead weight tons. Projections indicate a need to increase the capacity by another 200 million long tons of crude oil per year by 1985. The legal regime for licensing beyond territorial waters must be determined. Environmental safeguards must be established and enforced. Navigation and traffic control systems

must be constructed and operated. Someone must develop and approve standards for operating and maintaining pipelines or other means to bring the fuel to shore for further inland distribution. Assuring their compatibility with other developments or activities will bring in state, regional, and local interests as well as interests of other nations.

The confusion over responsibility for these interlinked and complex matters is symbolized by current legislative approaches to control the development of deep-water ports. At least six major bills are in the congressional hopper now assigning lead-agency responsibility for such developments alternatively to Interior, Commerce, and the Environmental Protection Agency, and noting cross-jurisdictional implications with other agencies as well.

It is quite realistic to anticipate a rapidly growing need to control the siting of other offshore structures, floating, moored, or fixed, including: powerplants, airports, waste disposal sites, mariculture platforms, and recreational and living accommodations. The Federal Aviation Administration, the Environmental Protection Agency, the Maritime Administration, the Departments of Defense and State, and other Federal agencies, and state governments, have an active part to play in these developments, as of course does private industry.

A Department for natural resources must be organized in such a way that it can take a leadership role in moving ahead swiftly but surely with whatever projects are chosen for development.

OBJECTIVES OF MARINE RESOURCE MANAGEMENT

Organizational remedies for the above depend in part on the purpose to be served. We believe the new Department should undertake three related but managerially distinct tasks which apply equally to land and marine resources. In marine terms they are:

- encouraging the development and conservation of marine resources including offshore oil and gas, other minerals, and fish, and of other uses of the coastal and marine environment including recreation, waste disposal, siting of facilities, and transportation to meet national needs;
- coordinating and regulating these activities in the light of their environmental impact, national economic objectives, multiple-use conflicts, and international implications;
- providing technical, engineering development, and scientific services that cut across organizational lines, within and outside the Department, including surveys, environmental monitoring, prediction and control, and basic information relating to engineering and technology development.

The failure to recognize the significance of these distinctions regarding

objectives and their organizational requirements is, we feel, in part responsible for a number of imbalances in the present Federal programs. For example, we note elsewhere: a commercial fisheries program that is strong in science and advisory services but weak in a national fisheries development strategy; a weather modification research program whose NOAA component is criticized by some as not sufficiently application- or user-oriented and whose Department of Interior component is felt by others to lack scientific breadth; and an ocean engineering industry which during the 1960's developed, with Government encouragement, extensive underwater technology under the mistaken impression that Government was going to expand its support of marine resource development.

ORGANIZATIONAL MEANS TO MARINE RESOURCE OBJECTIVES

A simple regrouping of present activities within any such set of objectives as those discussed above is not itself any guarantee of progress. Most of the relevant activities, even those now within the same department, are deeply imbedded in a web of political processes involving both the Executive Branch and the Congress through the congressional committee structure. As always when fairly fundamental changes need to be made, it will take a special effort both in the White House and on Capitol Hill to bring about the conditions for any reorganization to succeed.

In addition to clear statements of missions and objectives for the new organization and its major components, it is important to assure that certain key functions are performed and that the organizational means to perform these functions exhibit certain desirable features.

The resource development activity must be able to establish resource production and usage goals in the light of supply and demand projections, determine the means required to achieve them, and bring these means to bear, subject to policy constraints regarding national priorities and environmental protection.

The multiple-use coordination and regulating activity must be able to determine the economic and social consequences of each proposed development activity, determine its prospective impact on the other development efforts and on the environment, determine the trade-offs of alternative policies, regulate their execution in accordance with broad national goals, and plan, fund, and arrange for the carrying out of public works of national importance.

The scientific, engineering, and support services activity must assure the timely availability of the necessary scientific and other knowledge, and provide appropriate technical and scientific services where the benefits accrue to the public at large.

The new organization should be charged with:

- Working closely with private enterprise and of encouraging industrial

activities which will carry out the Nation's interest in marine resources because of the large capital investments needed and the private enterprise role in resources development.

- Maintaining an extensive and deep understanding of the marine resource objectives and activities of other nations, and working effectively in the international arena in accordance with national policy because of the enormous potential marine affairs has for international cooperation or conflict.
- Supporting and managing large-scale oceangoing and atmospheric facilities and experiments because of the nature of the ocean environment, its physical coupling with the atmosphere, and the essentially global extent of both.
- Establishing regional foci when necessary and working with the States because of the inherent local nature of many marine resource-related coastal problems.
- Maintaining a working relationship with universities and other research and development institutions through grants and contracts because of their large role in the conduct of oceanographic and atmospheric research and educational programs.

Two final attributes that we consider essential:

- The administrative levels for marine and atmospheric resource management responsibility should be commensurate with the administrative level for the management of land resources.
- The Department must coordinate its programs with the essential oceanic and atmospheric missions of other agencies such as those in the Department of Defense, the Environmental Protection Agency, and the National Science Foundation.

RECAPITULATION

NACOA concurs with advocates of a greater centralization and more effective leadership of the Federal activities in natural resource management. We support the concept of a Department of Natural Resources along the general lines developed in "Papers Relating to the President's Departmental Reorganization Program" published in February 1972.

However, we note therein a preoccupation with problems of terrestrial resources development and an inadequate assessment of both the opportunities and problems of developing marine resources.

These problems involve special relationships between resources and the marine environment quite different from those on land. They produce correspondingly special operating situations and special technological requirements as well as vastly more complicated issues of ownership, jurisdiction, and law. Although we agree that, at the highest policy and planning levels, the role of marine resources must be developed in a national re-

sources context involving all resources regardless of origin, we believe that at the policy implementation level the Department's organization should show a special marine focus by the way its oceanic, atmospheric, and other environmental activities are grouped.

Atmospheric affairs do not in general present the same problems of intermingling as do marine affairs. But weather modification, for example, also has specific operating situations, technology, and complicated legal issues of ownership and jurisdiction which are similar to those of the sea.

Detailed internal organization for marine and atmospheric affairs cannot be confidently recommended without knowing how the nonmarine resource management activities are to be organized. There is more than one way to do the job, but there are certain functions and principles which should be provided for by whatever the groupings are of programs and activities. The functions we see as particularly important to keep in mind are those of (1) marine resource development in fulfillment of production goals, (2) multiple-use coordination and regulation in the light of their impact on each other, the environment, and international agreements, and (3) the provision of the scientific, engineering, and support services to meet the multiple needs of the public, the government, and industry.

The need for a special marine focus for the second of these functions (multiple-use coordination and regulation) is in particular danger of being overlooked. Unless this function is adequately provided for in the new Department, the special problems and opportunities in making effective use of the sea are unlikely to be dealt with adequately in formulating overall national resource policy and plans, in exploiting individual marine resources to help meet national resource goals, or in acquiring and making available the marine and atmospheric knowledge and services required for these and other sea-going projects and operations.

RECOMMENDED ORGANIZATIONAL GROUPING

There is no unique organizational solution to the marine resource development objectives stated above. Furthermore, we are aware of practical and political feasibility problems and the not trivial consideration of key individuals and their qualifications. Special influences will, of course, be the new Secretary, his wishes, and the way the nonmarine portions of the Department are organized.

Nevertheless, we recommend that as the plans for the new Department evolve, consideration be given to the groups discussed below.

Science, Engineering, and Support Services

We suggest that the science, engineering, and support services component of a natural resources Department be built around the present NOAA (ex-

cept for its Coastal Zone Management Program) and Interior's Geological Survey. It could reasonably include the R&D Laboratories of the Corps of Engineers and the R&D program of MARAD. It would logically include the research and service components of the Bureau of Sport Fisheries and Wildlife, and possibly some parts of the National Science Foundation's IDOE (International Decade of Ocean Exploration) program.

It should also develop a research grant program with key nongovernmental laboratories and universities not subject to the restrictions placed on NOAA's Sea Grant program in the support of ships, platforms, and essential shore facilities. It is important that this not be done at the expense of ONR and NSF programs. The academic community is of great value to ONR and NSF who, over the years, have developed a capability for effectively using this outstanding scientific competence.

In view of the strong technical content of science, engineering, and support programs and their methodological similarities and mutually supportive and cross-fertilizing properties, we recommend a single administrator be given the responsibility for their management. Needless to say, he should be highly qualified in science, engineering, and technology management.

Pending the buildup of a satisfactory in-house capability, a special need exists for using the unique technical competence of naval personnel and facilities to expedite the transfer of naval ocean technology developments to civil applications of industry and government and to insure that there is a minimum of duplication and maximum coordination of effort in this technology within the Federal sector. As an immediate action, an appropriate naval official, such as the Oceanographer of the Navy, could be designated the Federal Coordinator for Marine Technology Development. In his role as Coordinator, the Oceanographer would be required to submit to OMB annually his assessment of past Federal action and his plan for future activities. A similar Federal coordination mechanism and authority has been very effective in the area of atmospheric science.

Multiple-Use Coordination and Regulation

We recommend that the organization for marine multiple-use coordination and regulation be developed around NOAA's Coastal Zone Management Office, expanded to include the Corps of Engineers' civil functions, MARAD, and the Coast Guard. It could also include portions of the Bureau of Land Management, the Economic Research Service, the Bureau of Sport Fisheries and Wildlife, the National Marine Fisheries Service, and the Bureau of Outdoor Recreation.

A strong effort should be made to build a major capability into this part of the new Department. It is not an exaggeration to say that this office should be developed into an activity which can provide the analytical

basis for policy and planning decisions for a national marine affairs strategy and oversee its implementation through its public works, permit, regulation, and enforcement programs.

This further depends heavily on close interaction with the full range of technical and other services provided by the science, engineering, and support services organization referred to previously.

Resource Development and Conservation

If a coherent organization for marine affairs coordination and multiple-use management were developed to the extent recommended, much of the uneasiness we feel about a possible loss of marine focus, position, and support in the resource exploitation portions of the Department would be relieved. With the exception of fisheries, marine aspects of other resources development, such as energy, minerals, ports, transportation systems, and recreation could very well be grouped organizationally with their terrestrial counterparts in the Department along the lines suggested in the President's Reorganization Program Papers, where Administrators for Energy and Mineral Resources, Water Resources, and Land and Recreation Resources are identified at the top line management echelon.

Fisheries is a special case, since its terrestrial counterpart is in a different Department, Agriculture. Also, although both NOAA's National Marine Fisheries Service and Interior's Bureau of Sport Fisheries and Wildlife have competence that would contribute to reasonable U.S. development and conservation goals, the global reach of fisheries problems is such as to suggest a high level spot where its voice will not be lost.

The New Emphasis

Given all this, our recommendations for marine and atmospheric affairs differ from those of the Reorganization Program Papers of 1972 primarily in the expansion of the role and program responsibilities of the Administrator for Oceanic, Atmospheric, and Earth Sciences, the establishment of a major additional function (that of marine affairs multiple-use coordination and regulation), and the establishment of an office of marine living resources.

We recognize that it takes time both to form a new Department and to have it evolve into an effective working unit once formed. NACOA intends to continue its discussion and commentary during all of this process. But for now, making the right kind of a start is the pressing national business.

Energy and the Oceans

The oceans must play an increasing role for the United States during the next 15 years as we are forced into a difficult transition from primary reliance on domestic terrestrial sources of fuel to substantial use of energy from offshore oil and gas, from foreign oil and gas, and from nonconventional sources. NACOA believes that time is at a premium in balancing proper safeguard of the environment with the Nation's need for the production of offshore oil and gas, the importation and refinement of crude oil, and the placement of power plants in the coastal zone. NACOA considers that the ocean is a medium in which substantial development of energy-related activities can take place at less environmental cost than can similar growth on land. Its use for such purposes should be furthered.

A Difficult Transition Period

The energy crisis describes a difficult transition period of perhaps 15 years as we are forced to go from reliance on domestic conventional crudes for 65 percent of our national energy needs in 1971 to substantial utilization of crude oil from nonconventional sources, increased reliance on offshore oil and gas, buildup of our nuclear capacity, development of other sources such as geothermal and solar energy, and the importation of much greater quantities of foreign oil and gas.

NACOA concerns itself here with the part the oceans should be expected to play in meeting the growing demand, for the problem of energy will pervade most aspects of problems of high national priority in the decade to come and no possibilities can be left unexamined.

Crude Oil and Natural Gas Situation

The domestic price of crude oil is rising as our supply situation tightens, being above \$4 per barrel for some low sulfur crudes. At this price it is becoming economical to inject chemicals along with water to improve oil recovery. Industry now recovers, on the average, slightly over 30 percent

of the oil in place in known reserves. With advances in secondary and tertiary techniques, the average recovery from known reservoirs could reach 50 percent or more, adding in excess of 70 billion barrels to reserves.

If the price continues upward, crude oil from unconventional sources will become economic—first from tar sands and heavy crude deposits, then oil shale, and finally from coal.

At the present time crude oil and natural gas supply over 75 percent of our total energy requirements. Economists predict that by 1985 our demand for energy could nearly double the 1970 level but still with petroleum and natural gas as the major source (65 percent). Thus U.S. reserves* of crude petroleum, now at a peak, can be expected to decline. Over the past 15 years proven reserves of crude oil in the lower 48 States have fallen from an equivalent of a 12-year supply to a 9-year supply. Similarly, proven reserves of natural gas have dropped from a 22-year supply to an 11-year supply. In 1972 imported crude and petroleum products supplied about 25 percent of our domestic demand and this percentage was increasing rapidly. The 1985 imports will probably exceed 50 percent unless substantial new domestic discoveries are made and exploited. A substantial increase in importation of liquified natural gas is also forecast.

Hydrocarbons can be derived from our very large deposits of coal and oil shale, but it will be from 10 to 15 years before these sources can be utilized economically in large quantities without significant damage to the environment. Conceding that this technology will be available, it is still very important for the United States to remain economically competitive in terms of its basic cost of energy.

The near term domestic energy resource shortage is a consequence of this required transition over the next 15 years. It can be minimized by: (1) increasing our petroleum discovery rate with particular emphasis on offshore resources; (2) importing more foreign crude and natural gas; (3) increasing the percentage of oil recovered from known reservoirs; and (4) realistically working to control the demand side of the equation—certainly not the least important.

The oceans will play a very important role in the first two of the foregoing approaches.

Offshore Oil and Gas

The most promising way to increase our domestic discovery rate is for an intensified exploration and drilling effort offshore on the continental margins. The U.S. onshore, excluding Alaska, has been one of the most

* Proven reserves are reserves of oil and gas that exist in known reservoirs and can be produced with known technology under existing economic conditions. New discoveries, improved technology, and increase in price all have the effect of increasing the reserves.

intensively explored regions of the world. The opportunities for finding new large reserves onshore are now limited and most of these will probably be deeper and more costly to find and produce.

Geologists regard the Outer Continental Shelf and slope of the United States and offshore Alaska to be generally favorable prospective areas for oil and gas. Recoverable hydrocarbon resources on our Outer Continental Shelf have been estimated by the U.S. Geological Survey to be upwards of 160 billion barrels of crude oil (four times proven reserves at year-end 1972) and upwards of 800 trillion cubic feet of natural gas (three times proven reserves at year-end 1972). Comparable amounts are also possible on the continental slope. How much will eventually be found or produced from either of these areas will depend on technical, economic, and political factors. Offshore production is already established in Louisiana, Alaska, and California.

Offshore oil and gas drilling and producing operations encounter substantially different environmental conditions from those onshore. In addition the offshore, being in the public domain, supports a complex and varied mix of activities—fishing, shipping, recreation, and defense as well as exploitation of the mineral and petroleum resources beneath the sea.

Harmonizing all these operations is no easy matter and efforts to develop this domain are being opposed by major environmental groups who, concerned by possible adverse consequences, have brought drilling operations to a near halt in offshore California, slowed lease sales in the Gulf of Mexico, proposed legislation to ban leasing and drilling operations off the East Coast, and have entered suit blocking the Trans-Alaska pipeline from the North Slope. The construction of new refineries has also been affected. In past years four or five major new refineries or major expansions, with capacities of 100 to 200 thousand barrels each per day, were under construction at any given time. Today there are none. One important reason is because the oil companies have found it difficult to obtain siting which satisfies economic and environmental criteria.

Safeguarding the Environment

Industry, as part of an increased environmental awareness is spending large sums on research to develop new technology to reduce risks of well blowouts and spills and on techniques to confine and clean up the oil should accidents occur. The Coast Guard is taking the Government lead in the cleanup area. Numerous studies sponsored by Government and industry have focused on the impact of various offshore operations (drilling, producing, and transportation) on the biological, chemical, and physical environments both at sea and along the strand.

Industry is also pressing the development of new technology to place well heads and production systems on the sea bottom, thus allowing a

breakaway from the surface to concentrate on totally submerged operations in an environment unaffected by weather. The industry expects that this technology will cause the curves that show costs rapidly rising with depth to be discarded and replaced by ones that increase only moderately with depth. The near term goal is to have wells economical in 1000 feet of water. Such systems will be beyond the reach of storms, high seas, and ship traffic—hazards to which fixed production platforms that extend above sea level are now exposed. Subsea systems, of course, have potential hazards of their own, but there seems to be no fundamental reason why they could not be handled.

Of the more than 17,000 wells drilled in our offshore only a handful caused problems, and there seems to be little hard evidence of long-term environmental damage from those that did (although this question is not entirely closed), and the short-term effects can be and have been severe. From experience in oil production in the Gulf, less contamination of the ocean apparently results from offshore drilling, production, and pipelining to shore than by shipping in a like amount of oil by tankers.

NACOA feels that one of the top priority Government functions should be to establish environmental norms in the offshore and along the strand and to provide environmental forecasts of sea-states, currents, biological background, and chemical pollution. Such norms are essential to setting pollution control and siting regulations. Once the norms are established periodic monitoring should be maintained to recognize changes and to help determine whether these are due to natural causes or to industrial activities and in the latter instance what control measures are indicated. Forecasts would enhance safety and help protect the environment. Government geophysical surveys should provide a general overview of the sub-bottom structures. Where necessary, special emphasis should be placed upon data needed to ensure safe procedures for exploration and recovery operations.

Financing offshore exploration, drilling, and production can and should be done by the petroleum industry. However, since such operations will be done in areas largely under Federal jurisdiction, it will be necessary for Government to establish regulations that will provide protection for the ocean environment, and compatibility of petroleum operations with other activities within the coastal zone, while allowing proper incentives for the petroleum industry to enable it to generate the very large capital funds required to develop these offshore petroleum resources. Also, regulation should not be such as to jeopardize other international positions on offshore questions.

Deep-Water Terminals vs. Deep-Water Ports

While we fully expect efforts to encourage discovery rate, improve recovery efficiency, and control demand to be successful, it will be essential

that a very substantial increase in imports of petroleum be accommodated over the next critical 15 years. This means that we will need, in the very near term, deep-water facilities to offload the large tankers needed to handle the anticipated tonnage safely and economically.

As our dependence on foreign crude increases, more and more tanker traffic will enter U.S. ports. Foreign flag tankers of 200,000 dwt are common today, an increasing number of 300,000 dwt tankers are in service, and several in the 500,000 dwt range are under construction. These large tankers reduce sea-leg transportation costs markedly. Only one U.S. port (San Pedro, California) can handle a tanker as large as 120,000 dwt, although Seattle, Washington, could be adapted, and Machiasport, Maine, though undeveloped, has the requisite depth as does Eastport. Though Long Beach, California, is deepening its main channel to 62 feet, which could accommodate 200,000 dwt tankers, dredging present ports on the East Coast to suitable depths is either impossible or presents many drawbacks.

Deep-water oil terminals that can accommodate large tankers are one alternative to dredging present ports and could be financed by private industry. Government action would be needed in regulating siting and in protecting the ocean environment. Three deep-water oil terminals are presently under active consideration—Sea Dock near Freeport, Texas; Loop, near Grande Isle, Louisiana; and one off Delaware. Most of the deep-water facilities built in many locations around the world use single point moorings (SPM) and provide a capacity for a 24-hour turnaround for any size oil tanker. An advantage of SPM's is that they enable tankers to ride out storms with a minimum of risk.

There has been considerable attention given to the alternative of superports to handle a variety of bulk commodities. These could be sited on manmade islands offshore or sited on coastal lands. If superports are used in place of specialized oil terminals, most of the tonnage passing through such a superport, at least in the beginning, would be crude oil and refined petroleum products. Since such a large percentage of superport tonnage would be liquid petroleum needing special handling facilities, NACOA believes it would probably be preferable, at least initially, to use deep-water oil terminals independently of superports. Such an arrangement also has the advantage of making oil terminals, because of their relative simplicity, available at an earlier date—an important consideration—and could be financed by the petroleum industry. Also, problems of collocation are avoided.

The combination of SPM's and accelerated offshore leasing offers the shortest lead time for increasing crude oil capacity. We believe that provision of terminal facilities is vital. NACOA therefore recommends that: as a quick fix the United States have at least one deep-water single-point

mooring terminal operational in the Gulf by 1976, and have at least one deep-water single-point mooring terminal operational off the East Coast by 1978. Some such facility will eventually be needed on the West Coast; but its nature, because of the different alternatives and different conditions, is not as easily determined.

Siting—A Pressing Problem

Siting is a problem for energy-related facilities. Terminals associated with imports or offshore development must be in the coastal zone. While other facilities, such as refineries and powerplants, can be located elsewhere, cooling water availability and reasonable access to the consumer make the coastal zone attractive. But the coastal zone, as is increasingly evident, is attractive to many other uses—not all of which are compatible. How does this balance out?

It is natural to want facilities such as big powerplants, refineries, etc., located far from where one lives and some have suggested that in order to avoid building more, we simply curb our demands for energy. There is no question that conservation and efficiency should be a vital part of our national energy policy and that reducing demand would buy some time. However, it will take more than a substantial modification of our life style to negate the present need for new facilities. The projected annual growth of energy demand is given at 3.4 to 4.4 percent per year; the demand for electrical power is going up even faster and has been doubling every ten years for an annual growth rate of over 7 percent. This would be slowed by a change in demand, but to think it can be stopped, for the present at least, is unrealistic. The siting problem for new plants, in other words, won't go away.

Nuclear generating plants are destined to play an increasingly important role in meeting the Nation's electrical energy needs. Today, there are 34 operable nuclear powerplants in the United States; they provide a capacity of about 19 gigawatts (billions of watts) which is approximately 4 percent of the Nation's electric power capacity. Fifty-seven new nuclear plants are under construction, and 80 more have been ordered. Nuclear plants are expected to proliferate for the balance of the century at a rate approaching 20 percent per year. By the year 2000, installed nuclear capacity is expected to be 1200 gigawatts and to make up roughly half of our total electrical generating capacity.

One of the unavoidable byproducts of electrical generating systems, whether fueled by nuclear, coal, oil, or gas, is waste heat. In general the conversion of 1 BTU into electrical energy requires the release of 2 BTU's to the environment as discarded or waste energy. The rejected heat is normally transferred to a supply of cooling water taken from and re-

turned to a river, lake, or the ocean, or recycled through a cooling tower or pond where some of the water is consumed by evaporation.

The point is, the waste heat must be dissipated somewhere into the environment or used for purposes other than conversion to electricity. Improved powerplant efficiency can help extend our fuel supplies and also lessen cooling requirements. Since the oceans contain over 97 percent of the world's water,* their use as a heat sink should have the least noticeable effect on the environment. Many electrical generating plants should thus be sited to take advantage of the excellent heat absorbing capacity provided by the oceans. Nine nuclear powerplants in the United States are presently in operation at sites on bays or tidal rivers. The influence of their cooling water discharges into the ocean can be minimized with detailed knowledge of the existing physical and biological factors.

If upwards of 1000 nuclear plants are required by the end of the century, as is anticipated by some industry projections, some fraction should and will be situated in the coastal zone. To accommodate them, new approaches to coastal siting are being explored with an eye to conserving land. One is the construction of so-called "nuclear-parks" in which a number of nuclear generating stations would be clustered at a single location. Another sites nuclear powerplants offshore on floating "islands" inside protective breakwaters. Other energy generation and energy conversion facilities can be envisioned that would benefit by ocean siting.

NACOA stresses that an accommodation must be reached between the legitimate concerns for our environment and the energy needs of a dynamic society. NACOA feels that both can be substantially satisfied if available technology is utilized and if a concerted and unified effort is made to carefully weigh the alternatives and then move ahead. NACOA feels that the oceanic solutions to many of these problems have not received as much attention as they merit.

NACOA feels that a national objective of our ocean program should be to have the technology and environmental information in hand such that decision-makers can judge the consequences of proceeding with offshore oil and gas development as well as the placing of new energy-related facilities safely and economically in offshore waters. Several advantages can be identified. First, more coastal land could be retained for recreation or for wildlife preserves. Second, adequate cooling water could be obtained without the often severe problems associated with thermal discharges in restricted water. Third, by placing the facilities remote from people and in many cases placing them on the bottom, well below the turbulent environment of the surface, it is possible to design in much improved safety features. In short, progress doesn't have to mean a degraded environ-

* Roughly 2 percent is tied up in icecaps and glaciers and less than 1 percent is in fresh water lakes, streams, and groundwater.

ment. If properly done we can have both the needed energy as well as an improved environment. NACOA stresses the need for increased emphasis on improved ocean technology on the part of industry and government in support of their respective responsibilities.

Managing the Coastal Zone

NACOA supported the Coastal Zone Management legislation enacted October 1972 for two principal reasons. First, the legislation provided strong coupling between the technical and scientific expertise and the management functions needed for the coastal zone. Second, the legislation closely matched, supported, and could be expected to further coastal zone management in many states. But the Act was neither funded in FY '73 nor included in the budget requests for FY '74. In this chapter, NACOA discusses the consequences of delaying implementation on various matters of high national priority, finds them to be costly, and recommends a substantive start in funding existing legislation.

Introduction

In the United States, as in other developing nations of the world, awareness of the importance and vulnerability of the coastal zone is increasing. The Commission on Marine Science, Engineering and Resources (The Stratton Commission) established clearly the aesthetic, social, economic, and environmental problems pertaining to this complex, dynamic, and yet fragile area and recommended a national program. Many other political, industrial, private, and scientific bodies have reinforced these conclusions—recommending positive action. NACOA in 1972 strongly urged enactment of legislation establishing such a program. In late 1972, Congress passed and the President signed into law P.L. 92-583, the National Coastal Zone Management Act. Subsequently, the Secretary of Commerce established an office within NOAA to administer the Act. Progress, eagerly sought by many, seemed finally under way.

Unfortunately, though the National Coastal Zone Management Act had been duly enacted, complete with authorization of expenditures, no appropriation was sought in a supplemental FY '73 request or in the budget request for FY '74. The program, presently sustained only by meager caretaker funds squeezed from the beleaguered budget of NOAA, has been suppressed to a very low level.

Inasmuch as the coastal zone encompasses those areas of the oceans and the margins of the land which relate most directly to the current big-E issues—Environment, Energy, and Economics—this lack of aggressive action on an approved national program which bears so strongly on all three could have serious economic, social, political, and environmental repercussions.

Because of the sensitivity of this critical geographic area and of our concern for the future of the coastal zone—a concern shared by many groups and individuals—NACOA has had all aspects of coastal zone activity (Federal, state, local and industrial) under relatively constant review for over 15 months. This review only confirms and reinforces prior convictions. We see no reason to moderate the stance or alter in any way the recommendations made in the 1972 Report.

Why Delay?

NACOA understands that several concerns (perhaps among other less obvious factors) were involved in establishing the current holding pattern on the Coastal Zone Act. Among them are concerns over: (a) compatibility of the provisions of the Coastal Zone Act with total land-use management on a national scale, (b) departmental assignment, and (c) budget limitations.

Since the Coastal Zone Management Act was made compatible with the several land-use proposals even before it was enacted, this concern seems unnecessary. It is understood that the congressional proponents of each have agreed on details for coordination.

Assignment of the program to the Department of Commerce in the 1972 Act was justified, NACOA believed, because “the Committee feels very strongly that there should be strong coupling between the information-gathering and the management functions.” * NACOA went on to say “. . . the fact that the Department of Commerce, with NOAA, would have the primary Federal responsibility for implementation of this program . . . assures the opportunity of this coupling.” ** We still believe the assignment was justified! In the light of possible reorganization of environmental and resource management and technical agencies now being widely discussed, the concern regarding the assignment to Commerce is further weakened. Regardless of the outcome of the proposed reorganization of environmental and resource management agencies within the Federal Government, development of an effective national coastal zone management program is so important that continued delay on this ground seems unwise.

* “First Annual Report by NACOA,” *op. cit.*, p. 39.

** *Ibid.*, p. 39.

Economic concerns, the need to keep governmental expenditures to a minimum, are more substantive arguments for delay, even though the costs of initiating the coastal zone management program seem low compared to others which were supported—especially in terms of desirable priorities and potential productivity. However, the obvious short- and long-term economic importance of achieving reasonable control over the environments and resources of the Nation's coastal margin is so great that this particular budgetary squeeze could very well be counterproductive.

The Need for Action

With passage of the National Coastal Zone Management Act of 1972 and the vigorous beginnings undertaken by NOAA, NACOA was encouraged to expect that confusion would diminish and order emerge. Unfortunately, while lack of funding has limited Federal activity to some planning and fact-finding efforts, the scene at the State level has been in ferment. Individual States have taken action. For example, California passed Proposition 20, which brought into being California's Coastal Zone Conservation Act of 1972. The Virginia Wetlands Act of 1972, an attempt to control by permit the use of intertidal lands which since 1819 have been in private hands, was also enacted. The Delaware Legislature declared a 1-year moratorium on coastal development while a group of experts was tasked with providing guidance for Delaware's long-term coastal zone utilization. Other States have taken action. Some have been comprehensive, encompassing the entire coastal areas, as in the California and Delaware cases. Others have been more narrowly focused on specific segments, like the wetlands in Virginia. NACOA is aware that many other management activities are underway at State and local levels and that planning is being carried out by many others.

NACOA is pleased to note this vigorous action, believing that it is ample testimony to the criticality of the coastal zone, but certain aspects of its management must be truly national. The people and economic activity of the heartland as well as the coastal area are closely dependent upon the metropolitan centers, ports, internal waterways, oceanic lanes, mineral and fishery resources, and the recreational and aesthetic resources of the margins of the seas and the Great Lakes. Too, regional (interstate) needs exist. A great danger exists in unilateral and uncoordinated action by State and local governments. Local, State, regional, and national interests are often in direct conflict when offshore developments like deep-water ports, oil exploration, and production platforms, and other nationally or regionally important projects are proposed. The management and utilization of living resources of the coastal zone has proven to be a continuing area of irritation and disagreement. Conflict and problems between States and regions are yet to be resolved. Persistent conflict has seriously impeded

and often halted progress needed for the benefit of many at the expense of local benefits for few. The National Coastal Zone Management Program should, as a matter of high priority, be provided the means needed to effect better State and local coordination and assure that regional and national interests will be fairly served.

Balanced and Responsible Concern

Lest we be misunderstood because of this emphasis on national and regional needs, for effective utilization of the coastal zone, NACOA reaffirms its keen interest in bringing coastal waters, coastal bottoms, and the coastland areas under balanced and responsible control in the light of environmental imperatives. We advocate preservation of unique areas of biological importance, active conservation of open space and natural areas where threatened, and limitation of development to areas and amounts justified by the criticality of basic societal needs like energy and transportation. However, we are convinced that in many instances, ways can be found to allow reasonable usage with tolerable or no damage. We do not believe that it is in the best interests of the people of this country or of any State to eliminate or permanently impair effective use of the region. We are convinced that the Coastal Zone Management Program is best pursued and funded under an arrangement whereby State governments and the Federal Government participate together within effective national guidelines as was provided for in the Act.

Research and Development in the Coastal Zone

To aid rational management of the resources and environments of the coastal zone, increased research and engineering activities will be required. Baseline environmental studies are needed, resource location and evaluation are required, and new and/or more effective means of conservation, use, and preservation are necessary. A number of Federal R&D activities are relevant. For example, the Sea Grant Program of NOAA, certain National Science Foundation projects, the MESA * program of NOAA, the fisheries programs of NOAA's National Marine Fisheries Service and Interior's Bureau of Sport Fisheries and Wildlife (i.e. P.L. 88-309 and P.L. 89-304). There are others. Unfortunately, serious reductions in funding of most, and in the rate of growth in others, have resulted from the recent budgetary impoundments and reduced requests for FY '74. Some vessels used for coastal, environmental, and fisheries-related work have been deleted from the fleet. This general cutback is unfortunate since solution of the economic and environmental problems related to the coastal zone depends on improved knowledge of the processes and phe-

* Marine Ecossystems Analysis.

nomena. Baseline data are needed and design, construction, and operation capabilities are required if we are to manage the coastal zone well. The price of inadequate information and lack of design and engineering data, skills and equipment will be faulty design or overdesign. Each of these shortcomings reduces the ability to manage effectively and frequently results in economically significant overexpenditures, even losses. Improvement and even expansion of the effort in this area is clearly justified on grounds of its relevance and importance to solution of the major problems of the time and of the future.

Summary

The passage of the Coastal Zone Management Act of 1972 was a milestone of national importance. It was, however, followed directly by an Administration decision not to fund the program for fiscal years '73 and '74. While the Federal Government is marking time, many of the states are moving ahead in the best way they can, and some confusion has begun to appear due to lack of a properly funded Federal program.

Basic scientific knowledge and technology relative to coastal environments and resources are inadequate to the tasks ahead. Decisions are going to be made based upon the knowledge available. In many cases the price of this dearth of information and technological inadequacy will be gross overdesign and the resultant economic penalties. Coastal fisheries and biological research, particularly the biological information needed to make rational decisions on resource development and utilization, appear grossly underfunded.

NACOA strongly recommends and urges that the National Coastal Zone Management Act of 1972 (P.L. 92-583) be funded to the full amount authorized by law and that its implementation in all aspects be vigorously pursued. NACOA also recommends that the budgetary priority be increased for R&D programs bearing directly on the coastal zone management planning and regulation decisions.

Atmospheric Activities

The United States has led in the remarkable advances of recent years in observing, describing, understanding, and simulating large-scale atmospheric behavior. NACOA finds it is now time to increase the relative effort on smaller-scale meteorological phenomena which nevertheless have large local impact—flash floods, tornadoes, severe hail, etc.—and to improve local forecasts. NACOA also recommends greater attention be paid to monitoring the public response to weather forecasts and warnings so as to improve the ultimate effectiveness of dissemination and to increase its value to weather sensitive activities.

Although we appear to stand on the threshold of practical weather modification, and some limited aspects are now operational, not enough is known about it to make it ready for general operational use. In addition to unsatisfied questions in domestic and international social, legal, and economic areas, a great deal of physical research still needs to be done. Last year NACOA recommended focusing and coordinating the many small research programs now scattered widely through the Federal agencies. NACOA again recommends this be done and again recommends assigning NOAA lead agency responsibility because it has the bulk of the scientific expertise both theoretical and experimental.

Introduction

The last decade has been a period of remarkable advance in the atmospheric sciences. Perhaps the outstanding achievement has been the great strides made in observing, understanding, describing, and modeling (through computer simulation) the large-scale behavior of the atmosphere. This effort has had as a major objective extending the accuracy and the period for which reliable forecasts can be made. A secondary objective, of growing importance in the light of man's increasing intervention, is understanding the processes of climate change.

The United States has led the way in this effort, notably in the Global Atmospheric Research Program (GARP). Universities, NOAA, NSF, and DOD, using computers, satellites, aircraft, ships, buoys, and balloons, have coordinated to a remarkable degree both the organization and planning

of a well-conceived graduated series of observational and computer simulation experiments. This effort culminates towards the end of this decade in an experiment with strong international participation. We believe the practical and scientific benefits in prospect justify strong support for this program through its remaining phases.

While acknowledging this scientific and organizational achievement, and supporting the determination to carry it through to completion, NACOA recommends that greater attention now be paid to the problems created by weather and environmental phenomena at the other extreme, those that are of small or medium scale, geographically limited, short-lived, and exceptional in the sense of being at the same time both hazardous and infrequent in any one spot. We are referring to flash floods, tornadoes, severe hail storms, pollution "hot spots," sudden crop-damaging freezes, and short-term fluctuations in phenomena of great importance to operations, such as airport ceilings and visibility, and anomalous wave heights at harbor entrances, near shore, and at sea.

These phenomena share a number of properties that require a special approach in providing appropriate services. Reporting the occurrence of specific events in time for appropriate action becomes more important than scientifically exact descriptions of the phenomena themselves. In urging greater emphasis on the development of "user-oriented" forecast systems designed for hazardous situations, NACOA also notes that closer attention to user needs could pay off in increasing the usefulness of the daily, more or less routine, weather prediction services.

Natural Disaster Warning

During the fall of 1972, NACOA carried out an evaluation of the performance of the national weather and flood forecasting-warning-dissemination system during Hurricane Agnes. There were \$3.5 billions in property destruction—a new record—and 118 deaths. Hurricane Agnes put the capabilities and skills of the Nation's weather and flood warning system to a severe test.

As is customary after disasters of such magnitude, Dr. R. M. White, Administrator of NOAA, assembled an in-house Survey Team to gather detailed firsthand information from the weather service units involved, and from the communities affected by the flood events of Agnes, to assess the effectiveness of NOAA's storm and flood warning services and to profit from the experience. Dr. White asked NACOA to make an independent evaluation of NOAA's performance because of the magnitude of the calamity. What the NACOA panel asked of itself was whether these losses could have been avoided or diminished by more efficient warning service performance.

NACOA reported its findings to the Administrator of NOAA in a special report made public in November 1972.* NACOA concluded that, "While the technical and administrative resources of NOAA could be improved in certain respects, and work must be done in the area of public response, *primary effort must be focused on the warning delivery system.*" ** We wish to discuss further in this report the matter of delivery of warnings and forecasts.

Improving Delivery and Public Response

An effective warning delivery system must be capable of detecting an impending disaster, determining its scope, deciding on the type of warning to be issued, and disseminating the warning. On its part, the community thus warned must be prepared to take appropriate action. All of these components must function properly and quickly if lives and property are to be saved. The response time from detection to public action must be made short. While the Weather Service does not have the responsibility for public response, it shares responsibility with other agencies for final delivery to the public, and it does have the responsibility of assessing how successful to the whole is its part of the effort.

The National Weather Service (NWS) uses a number of arrangements for transmitting forecasts and warnings to the public. Many of the methods currently used are indirect. The mass media (radio, television, and newspapers) relay what is furnished them by the NWS, and, in some areas the public is reached through State and community action agencies. In other locations, the NWS communicates directly with the public both by telephone and through the use of continuous broadcasts over special VHF-FM radio transmitters. More extensive use of cable television is an emerging possibility for increasing direct contact with the public. None of these methods is entirely satisfactory alone, although collectively they could make up an effective system. Unfortunately, there are few places where the proper mix is both available and utilized. NACOA strongly urges NOAA to undertake the design and evaluation of pilot projects to determine and rank the various alternative systems for this purpose.

In addition to recommending that NOAA undertake the responsibility for making certain that warning messages are not only sent but are also delivered to someone who can take action, NACOA recommends that NOAA, in conjunction with appropriate action agencies, develop a moni-

* "The Agnes Floods, a Post-Audit of the Effectiveness of the Storm and Flood Warning System of the National Oceanic and Atmospheric Administration. A Report for the Administrator of NOAA." NACOA, GPO, Washington, D.C., Nov. 22, 1972.

** *Op. cit.* p. 2.

toring component of the disaster warning system to sense public response to the warnings and modify it in the light of public response.

Turning to the internal functioning of the National Weather Service, also discussed in detail in the Report of the Agnes Panel, we believe great improvement is possible by accelerating the application of existing communications and automation technology and procedures by NOAA. Furthermore, this capability is necessary to improved warning delivery. The two go hand-in-hand.

The exciting prospects which can now be provided by modern technology can be seen in the concept for the Automation of Field Operations and Services (AFOS). Its objective is to bring about maximum automation of the myriad of routine tasks now done manually.

In general, much of the technology applied today in the field services of the NWS is of pre-World War II vintage. It is true that weather radar is in widespread use, and that the radar data are increasingly distributed by slow-scan facsimile. It is also true that the observer is assisted by such modern weather observing instrumentation as ceilometers and transmissometers, but he still reads dials, records his observation in his own handwriting, and often cuts his own paper tape for transmission over teletype circuits. It is true that the forecaster has access to the output from sophisticated numerical weather prediction models run on some of the world's most powerful computers. But, to find whether rain has fallen in the next State in the last three hours, he may have to sort through many feet of teletype paper. The impact of significant advances in atmospheric sciences, and in exciting new observing techniques, such as the use of satellites, is dulled by the limitations imposed by the use of outmoded data handling and communications techniques. This is in spite of revolutionary advances in the state of the art in information handling and communications.

Perhaps the most striking paradox in the National Weather Service operations today can be seen by comparing its National Meteorological Center (NMC) with some aspects of its field operations. NMC is at the forefront in applying the science of meteorology and numerical techniques to day-to-day forecasting problems. In doing so, it is also pushing the state of the art in large-scale computer systems. As a direct result, the computer-generated 48-hour forecasts produced today have roughly the same validity or are just as useful as the 24-hour forecasts that were produced only a few years ago. On the other hand, in many of its field operations, surface observations are taken and recorded manually even though remarkable strides have been made in development of automatic weather stations.

The heart of the field portion of the proposed AFOS concept is the minicomputer and TV display equipped Weather Service Forecast Office (WSFO). The computer and display system will support the WSFO fore-

caster directly by performing other data handling functions such as automatic monitoring of forecasts and automatically alerting the forecaster when predetermined criteria are met which require his attention.

The same system can automatically collect observations from those automatic and manual surface stations, radar stations, and upper air stations within the WSFO's area of responsibility. In addition, the mini-computer system will automatically disseminate forecasts and warnings to Weather Service Offices, radio, television, newspapers, police, schools and other local users.

All WSFO's will be interconnected to each other and to the various National Centers (such as the National Hurricane Center), and the River Forecast Centers. This interconnection will be made via a National Digital Circuit in such a way that observations and processed data such as satellite images, forecasts, and computer products are available anywhere in the system.

With such a system, the forecaster can quickly be made aware of developing severe weather or a flood situation. He will have all the supporting observations, National Meteorological Center products, National Hurricane Center products, and National Severe Storm Forecast Service products in electronic storage for immediate display. He can call up from storage pre-designed warning message formats onto a TV display that he need only complete. With the press of a button, the warning can automatically be on its way.

The end result will be the automation of routine data handling, manipulation, and communications tasks. Exceptional events can be automatically called to the forecaster's attention. All this will free the man in the system from many routine tasks and permit him to do those things that require judgment and creativity. For example, with the situation as it exists today, it is very difficult for a small plane pilot to reach a forecaster who could brief him when he plans his flight. This represents a special requirement for forecast products. It is similar, though more crucial to safety, to the special requirement that a farmer might have for a weather forecast in making a decision about when to cut hay. There are many others. NACOA feels that there is much weather information that exists today within the National Weather Service that is not readily available to many groups of potential users who have special requirements.

We support the efforts of the NWS to automate routine functions and to free the forecaster for contact with users. NACOA strongly supports the preparatory steps already taken by NOAA to automate the system and urges that the implementation of these programs be given priority support. As these improvements are made, careful interagency coordination between NOAA, DOD, and the FAA should continue so as to guarantee that inter-

system compatibility continues, and that the quantity and quality of the observations and services are maintained.

Weather Modification and Control

Last year NACOA noted that we stand on the threshold of a new era of environmental control. We also emphasized that the field needs a balanced approach on several fronts. Public policy issues with both domestic and international ramifications are intensifying. Legislation, as well as studies of social and economic impacts, are needed. Further, the relatively modest funds allocated to research need to be focused to permit the program to move ahead in a coordinated fashion.

As we pointed out last year, weather modification within the Federal Government is carried out by seven agencies to meet their mission needs. The Departments of Agriculture, Interior, Transportation, and Commerce are all concerned with weather modification possibilities related to their responsibilities such as: precipitation and water resources management; reduction of damage from hail, lightning, and violent storms; abatement of hurricane intensity; and improvement of the capability to use airports where visibility is reduced by fog. What NACOA found lacking is a central strategy for the overall research effort. There is a common dependence on increased theoretical understanding of the processes involved, which is in turn dependent on accurate measurements, improved instrumentation, facilities for experimentation, computer simulation, and the ability to mount and manage large-scale field experiments. We had recommended increasing the NOAA lead role because it possessed the bulk of the capabilities required. We regret to note that this has not taken place, and further, that a step has been taken in the opposite direction—the assignment of lead responsibility for precipitation enhancement was transferred from NOAA in Commerce to the Bureau of Reclamation in Interior. Further, the budget was cut in half at the same time. It is important to note that precipitation enhancement is not ready for general operational use, and will not be, without much greater effort in research.

To elaborate, there is a common thread that winds through all the weather modification objectives that are supported by the various Federal agencies. This thread is the importance of understanding the fundamental physical processes involved. The traditional heavy reliance on statistical inference from experiments, where only the gross features of the phenomena could be observed, has carried the field forward to where it is today. Now, however, it is time to probe more deeply into the machinery of these phenomena if we are to go from modification to control.

For this reason, NACOA is concerned with the decline of the overall research effort in atmospheric and cloud physics. The resource levels which support basic laboratory and field work in cloud physics have declined to

the point where the small cadre of experts built up over the last twenty years is in danger of being dispersed. There is a danger that the funding authorities, in their quite proper zeal for practical results, will underestimate and undervalue the still extensive research that must precede reliable operational use.

At the same time a national research strategy must be guided in selecting priorities for its research effort by the prospects for practical payoff. These prospects have two dimensions: first, the "ripeness" or time to payoff; second, the importance of the payoff. Time to payoff involves primarily scientific judgment. The importance of the payoff in practical terms, however, involves a great variety of considerations regarding costs and benefits of all the alternatives, with weather modification being only one.

Two recent studies, still in prepublication form, have come to our attention. One is, "Weather Modification in the Public Interest," by R. G. Fleagle, J. A. Crutchfield, R. W. Johnson and M. F. Abdo at the University of Washington. The study undertakes to appraise the steps taken so far in developing the capability to modify weather, to identify critical issues which limit development or which influence the ability to direct weather modification in a socially responsible manner, to consider a means for rational systematic examination of weather modification programs, and to develop a policy for its implementation.

The study is concluded with a set of recommendations to insure the effective development and utilization of the capabilities of weather modification for socially beneficial goals. Among the actions recommended is the designation of NOAA as the lead agency in coordinating Federal weather modification activities and for managing a research program addressed to the critical scientific problems; the passage of legislation designating the Administrator of NOAA as the responsible official for decisions regarding weather modification activities that are directly related to the saving of lives or to other critical aspects of the national welfare; and the establishment of an institute which would conduct objective and thorough studies of policy alternatives and the impacts of weather modification activities. NACOA made similar recommendations in its first Annual Report last year.

The other study is a report by the Panel on Weather and Climate Modification of the Committee on Atmospheric Sciences, NAS/NRC entitled "Weather and Climate Modification: Problems and Progress." Three major goals proposed are:

- Identification, by the year 1980, of the conditions under which precipitation can be increased, decreased and redistributed in various climatological areas through the addition of artificial ice and condensation nuclei.
- Development in the next decade of technology directed toward miti-

gating the effects of the following weather hazards: hurricanes, hail storms, fog, and lightning.

- Establishment of a coordinated national and international system for investigating the inadvertent effects of manmade pollutants, with a target date of 1980 for the determination of the extent, trend, and magnitude of the effect of various crucial pollutants on local weather conditions and on the climate of the world. (NACOA wishes to point out that a relatively new candidate as a major pollutant for inclusion in the third goal is waste heat. Projected trends indicate this could be an observable factor in the general circulation of the atmosphere by the year 2000.)

NACOA supports these goals and believes that specific sets of research projects can and should be defined to insure their accomplishment.

We believe that NOAA should take the lead in developing and coordinating the implementation of such a program. Although the track record of the Interdepartmental Committee of Atmospheric Sciences (ICAS) is generally excellent, and ICAS should prove of value in this program as well, the dispersive forces serving to fragment the program are strong. We feel that a formal lead agency assignment is desirable and that NOAA is the appropriate candidate.

We believe also that the details of this program should be guided by a series of "requirement" analyses and that the appropriate mission agencies, such as Interior, Agriculture, etc., have a vital role to play.

Finally, as capabilities approach the stage of operational readiness, a systematic assessment should be required for approval of candidate operations. We suggest that mission agencies develop the capability to generate plans which provide cost and schedule estimates for the acquisition, implementation, and operation of weather modification systems. These plans should:

- show that the technology needed is sufficiently in hand—that primarily engineering rather than experimental effort is required;
- show that the mission and performance envelopes are defined;
- show that the best technical approaches are planned for utilization;
- show that trade-off analyses have been made to demonstrate that the proposed operational program is cost-effective in comparison with other techniques that could be used to satisfy the need;
- show that cost and schedule estimates are credible and acceptable; and
- show that legal, social, economic, and environmental impacts have been assessed.

Operational weather modification programs which can be depended upon to be effective in mitigating the effects of large-scale weather generated disasters are not in hand. Major technological problems still remain.

The search for solutions to these problems will require the design and accomplishment of extensive field tests, the execution of laboratory experiments, the development and test of complex numerical models, etc. Solutions to the many legal, social, moral, and economic problems associated with increased technological capability in weather modification will have to keep pace. In view of the anticipated difficulties, both technical and otherwise, and recalling our earlier discussion of the problem of providing adequate disaster warning, we again recommend that attention be given to providing incentives for the reduction of hazards through controlled use of areas susceptible to flooding by rivers and inundation by high tides associated with coastal storms and hurricanes. In the long term, the most effective measures of all may be preventive and protective measures for reducing vulnerability.

Fisheries Activities

NACOA finds two recent Government actions—the pending High Seas Fisheries Bills and the State/Federal Management Program of the Fisheries Service—welcome progress in laying the necessary groundwork for the species approach to the management of the coastal fisheries. However, NACOA does not feel that some progress is enough progress. Without a national planning effort such as that recommended last year, it will not be possible to allocate effort where it does the most good. Overview planning is therefore again discussed. In addition, NACOA emphasizes the need for economic regulation and uniform national and international enforcement, without which conservation or utilization plans could never be made effective.

Introduction

The predicament of the U.S. commercial fisheries remains acute. The trend which saw the U.S.-supplied share of the fishery products the Nation consumes drop in less than twenty years from about 70 percent in 1955 to about 35 percent in 1972 shows no sign of being reversed. If this continues, the pursuit, in the United States, of this ancient calling could be weakened beyond recovery.

The tangle of fisheries problems shows little sign of easing although at least two important positive Government actions, now underway and consistent with a national approach compatible with localized capabilities can only have a beneficial effect. The first is consideration of legislation such as the High Seas Fisheries Bills, HR 4760 and S 1069. The second is the start, even if slowly, of the National Marine Fisheries Service (NMFS) State/Federal Management Program.

These two actions are interrelated. The High Seas Fisheries Bills would provide a broad Federal authority on the basis of which actions *may* be taken. The NMFS State/Federal Program would help select the actions which *ought* to be taken.

In more detail: HR 4760 and S 1069 provide for Federal conservation

and management authority to regulate U.S. vessels when they are fishing beyond the 3-mile limit of the territorial sea. This would smooth differences between States by bringing pressure to bear for them to adjust variations in existing State law or practice by authorizing, in a manner which complements appropriate State fishery laws and regulations, consistent Federal regulations over all vessels in the 3- to 12-mile contiguous zone. The bills also provide the specific authority to the United States to carry out its obligations under international fishery agreements beyond the 12-mile limit which covers all U.S. vessels (or foreign vessels when covered by international agreement) on the high seas in the zone of agreement. This sets up the statutory authority for coastal fishery management by species rather than by geography.

The State/Federal Management Program of the NMFS is an important tool by which this management possibility can be put into sensible practice. Agreements for good fisheries management practice among all States involved in a specific fishery are being formed under this Program species by species. What is being sought is general understanding of the States' varying histories, practices, interests, and regulations to allow them to adjust to each other's differing needs in a visibly equitable fashion. The Program does this by bringing together as a planning body, technical representatives (biologists, economists, etc.) from each of the States involved in a given fishery. This body formulates a fishery management plan which is checked with various of the interested parties such as commercial and sports fishermen, conservationists, etc. The plan is then passed on to a policy or action board composed mostly of Directors of the State Fisheries Services. They, in turn, work the plan and get that which is agreed upon back to their respective State Legislatures for action.

This is a long haul. Furthermore, interactions among species, which are not well understood, could be very significant. At present the lobster fishery and northern shrimp management plans are close to the end point although several other species are in earlier stages of the procedure. An agreed lobster plan is back with the 11 State Legislatures involved in the fishery for individual enactments. It could be several years before it goes into effect. The northern shrimp plan which involves only three States, awaits some factfinding on the resource, but should be in effect sooner. Even so, successful application to inshore fisheries does not do it for the offshore, international fisheries.

Therefore, while the pending legislation, if passed, and the State/Federal Management Plan which is only now underway,* are good beginnings, they are only beginnings.

* This office has been in being for a little over a year. Support for it is such that it is one of the two programs in the NMFS (the other having to do with mammal protection) which has been given an increase in the FY '74 budget request.

Where is the National Plan?

The big question for NACOA is whether *some* progress is enough progress. On this score we are less optimistic because the solutions do not seem to be gaining on the problems. We believe the general situation of the U.S. fisheries will not be reversed until the NMFS can get a handle on how much effort must be put where, by whom, and *by when*. NACOA sees little evidence of a national planning effort for U.S. fisheries which would give assurance that priority is given the most critical issues—a far more complicated question than the choice of the most important species because it involves internal and international economic and legal questions.

The key recommendation of the NACOA Report in Fisheries last year was that a national planning effort for U.S. fisheries is necessary if the U.S. fishing industry is to better its place amongst the fishing nations of the world in the face of a tightening oceanwide race for the resource. Similar efforts at developing a coordinated strategy have been suggested before. They have not taken hold, perhaps because the approach to fisheries problems has been built on response to local or specialized needs. Such efforts are piecemeal. A larger view is needed. We will therefore go into a little more detail about the reasoning NACOA used in arriving at its recommendation for a planning effort and perhaps, in that way, help get things started.

Finding the Range

Our national position on fisheries is not independent of our international position and discussion of a national plan should therefore be reviewed against the backdrop of the stand on fisheries taken by the United States in preparation for the Law of the Sea Conference in 1974. We quote last year's succinct statement on this.

The U.S. position with respect to the fisheries question has been slow in formulation because of the lack of an agreed industrywide position. Now, however, the industry as a whole has agreed to support the position prepared by the U.S. Working Group. The coalition of interest has been largely induced by the realization that the current worldwide fishing capability can grossly reduce the catch of currently marketable fish and alter the relative species balance in a major way if uncontrolled and unregulated. The position proposed is to assign each coastal fishery to the adjacent state for management and licensing; to assign responsibility for anadromous fish to the country in whose waters the fish spawn; and to rely on multilateral arrangements for the pelagic fisheries. *The basic approach is to place priority on conservation of the resource.* This approach, in the case of the coastal fishery, has the important corollary that the fixed territorial concept is removed from the important fisheries domain, and should help relieve the pressures which appear to be driving territorial limits outward.*

* "First Annual Report to the President and the Congress by NACOA," GPO, Washington, D.C., June 30, 1972, p. 7.

Three essential features stand out: (1) general recognition that the threat to the resource is not the local problem of a particular fishery or a particular section of the country; (2) priority to conservation of the resource; and (3) the "species approach" in which management using sound biological and economic principles, rather than geographical considerations, should govern, with preferential access for the nation off whose coasts the fisheries lie. To this we would now add emphasis on national and international enforcement of fisheries agreements.

It should be noted that, though the U.S. position on "species approach" hasn't changed, estimates of the chances for effective international agreement at the Law of the Sea Conference have seldom been very optimistic. But whatever does happen, *some* arrangement for greater control by the coastal nations over the fish stocks off their shores for the purpose of both management and of harvest seems likely and should be anticipated. The United States must start planning now to be in a position to take advantage of such preferential access or some similar arrangement if and when it is worked out—preferably with, but if necessary without, international support. The United States must protect its coastal and anadromous resources from overfishing.

What these first planning steps should be is not common ground. Despite general agreement on the necessity for a national approach as given in the last Annual Report, NACOA could report no consensus on where to begin. But suggestions to emphasize correction of jurisdictional problems, inventory the assets, and regulate or limit entry so as to control the fishing effort predominated. It was clear to NACOA that all of these aspects had to be worked on at the same time. This is what makes it so complicated. If essential agreement on what to do first is needed before action is taken, and if there is no clear consensus on what to do first, it may be necessary to make the several approaches at the same time, not in series. Otherwise every possible solution is torpedoed by the unanswerable questions about "other" aspects of the complicated fishery problem.

That is why, last year, NACOA suggested setting a provisional planning target for an increased share of the domestic market to be supplied by domestic fishermen. We may have created some misunderstanding by not making it explicit that the goal (50 percent of the domestic market to be supplied by the domestic fishing industry by 1980 as opposed to the current share of 40 percent) * was a suggested target intended to uncover problems and obstacles standing in the way of achieving any reasonable goal. If this target turned out to be unrealistic, why then it would have to be changed. If the assumptions, either about the supply or about the de-

* The increase in share of the market of 10 percent coupled with market growth at the rate of the last three decades, implied an increase of 40 percent in fish supplied.

mand, turned out to be unworkable for 1980, once again the target would have to be changed. And so on.

NACOA reaffirms the desirability of setting such a market target with due regard for the practical limits on any individual species, and then working backwards to see what would be required of U.S. science and industry to supply that market, and what else in the way of legislation or government programs would have to be done to make these requirements achievable. Setting a target is simply a way of looking at it all together. If a gap shows up between what is aimed for and what one can expect, it might indicate increased emphasis on aquaculture, or the desirability of changing the requirements for fishing-vessel construction, or the need for limiting entry in some fisheries, or the need to emphasize certain problems for research, or for working at reducing social costs, etc. One cannot go at this fishery by fishery. Each has to be looked at nationally and all at the same time.

Planning, Regulation, and Enforcement

In any brief exposition of an approach to a complicated problem, emphasis on certain fundamental steps should not be taken as disregard for other, perhaps equally critical steps, which will have to be taken later on. NACOA is aware that a target is not a plan, and a plan is not action. The course of action, which will have to be worked out in detail, must be worked out against a general understanding of the importance of fisheries to the United States and with due regard for the interaction between economic, biologic, legal, and market problems. NACOA maintains its belief that, given some assurance of the continued availability of the resource, and assurance of the right to fish for a specified tonnage, individual enterprise would find an attractive economic environment had been created because uncertainties would then be limited to the normal risks of doing business. But an "atmosphere for redevelopment" means only that there is a chance to succeed, it does not mean that success is guaranteed. To provide that chance, the steps have to be taken with due regard for the following six conditions:

- Fisheries, as part of the national wealth, are a resource which we must husband.
- Conservation by agreement, by regulation, and by uniform national and international enforcement, is a necessary consequence of this regard.
- Jurisdictional problems, while among the most difficult to solve, are nonetheless susceptible to attack because they lie among the issues which can be resolved by patience, facts, and negotiation.
- Conservation is not realistically achievable by biological management

considerations alone. The Federal Government must also work out an approach to economic regulation of the industry with due regard for historic rights and social consequences. NACOA believes that unless there is a limit to fishing effort, the inherent surge to over-capitalization in any successful fishery will soon make it marginal. Restoration of fisheries already marginal can be brought about only by such means.

- Protection for the coastal and high seas fisherman needs higher priority than heretofore given. This is less a question of force than it is of enforcement. Differential enforcement of fisheries regulation on our own fishermen is neither fair nor ultimately successful in conserving the fishery. This implies stronger effort to achieve international enforcement of sound fishery management rules.
- Subsidized capital loans and technical assistance to developing countries should henceforth be conditioned on their compliance with international agreements on enforcement of conservation and fisheries rights.

Enforcement is no easy matter. Its requirements run the gamut in delicacy from the scalpel to the jackhammer. Enforcement should be concerned with economic regulation and conservation measures rather than be dominated by political considerations. In each category U.S. and foreign nationals are involved. Amongst foreign nationals there are those signatory to a pact, those signatory but not granting rights of reciprocal inspection, and those not signatory. However, the simple fact emerges that while the United States is in a good position to enforce sensible conservation rules on its own nationals, it cannot easily and uniformly enforce them on foreign fishermen. It naturally outrages those U.S. fishermen, who, while agreeable to abiding by conservation regulations, also want to make a living in a market where not all the competitors are forced to abide by the same rules.

There is thus a tug of war between those pressing for unilateral action in a fishery where the competition is distorted by differential enforcement, and those who cannot see the United States do other than abide by the rule of international law even when it puts some at a disadvantage. It may be that the physical surveillance and enforcement capabilities of the United States (satellite observation matched to the radio reporting of position in the case of tuna convention enforcement, for example) can be offered to other signatories so that enforcement could be more equitably distributed. This is clearly a complicated question and the circumstances vary from fishery to fishery both in nature and in emotional and economic impact. As a principle, NACOA espouses improving general enforcement on all concerned rather than in falling back where we are ahead of the field. But NACOA realizes that the men on the line may have neither the

economic reserve nor the patience to wait indefinitely. These matters must be pressed with more urgency than has been true in the past.

Proper enforcement is one of the keys to conservation of the world resource. It becomes less problematical as recognition grows of the danger to the resource. On the national stage this time has apparently come. We must press for it ocean-wide.

Pace and Direction

NACOA strongly recommends:

- (1) Passage of the High Seas Fisheries Bills such as HR 4760 and S 1069 which would assist both Federal and international good fisheries management.
- (2) Development of a national plan by the Secretaries of Commerce and Interior for the use of the national fishery resources.
- (3) International agreements incorporating mechanisms for the conservation of stocks upon which United States fishermen depend, and greater awareness of the problem of international enforcement.
- (4) Continued support of the species approach in the coming Law of the Sea Conference.

What NACOA finds lacking is pace, more than direction. Some of the right things are being done, but only some and not quickly enough. Coastal matters are being worked out, but only at a snail's pace. International matters are being worked out, but as if avoidance of conflict were itself a victory. Meanwhile the fish stocks slip, the young men go into other work, and as a Nation we import most of the fish we eat. What we do have to find out is whether we will or will not do something about it.



THE SECRETARY OF COMMERCE
Washington, D.C. 20230

August 15, 1973

The President
President of the Senate
Speaker of the House of Representatives

Sirs:

I have the honor to submit, in accordance with Public Law 92-125, August 16, 1971, the Second Annual Report of the National Advisory Committee on Oceans and Atmosphere (NACOA).

Enclosed also are my comments and recommendations which are required by the Act.

Respectfully,

A handwritten signature in black ink, appearing to read "Philip S. Holt".

Secretary of Commerce

Enclosures

**COMMENTS AND RECOMMENDATIONS OF THE
SECRETARY OF COMMERCE ON THE
SECOND ANNUAL REPORT OF THE NATIONAL
ADVISORY COMMITTEE ON OCEANS
AND ATMOSPHERE**

PREFACE

I have reviewed the Second Annual Report of the National Advisory Committee on Oceans and Atmosphere (NACOA) and have consulted with the other interested agencies of the Federal Government. I wish to express my appreciation to the Committee for its appraisal of some of the key problems in the Nation's oceanic and atmospheric effort.

The Committee has focused on major issues requiring early attention by both the Executive and the Congress. While the views expressed by the Committee diverge in some respects from courses of action already underway or planned by the Administration, I find the goals which the Committee seeks to achieve in general agreement with those of the Administration. Many of the Committee's specific recommendations are now being implemented. Some will be studied further. However, all of the views and recommendations of the Committee will receive serious consideration.

To facilitate the comparison of my comments with the recommendations of NACOA, I have organized them in accordance with the chapters of the Committee report. In these comments I will seek to place in perspective the Administration views of the issue raised by the Committee.

INTRODUCTION

The Committee has made a major point in its introduction of the impact of the curtailment of Federal spending during fiscal years 1973 and 1974. That there have been significant impacts upon the Nation's oceanic and atmospheric programs is undeniable. The

President has indicated repeatedly the overriding national need for holding Federal spending in check to minimize inflationary pressures from Government spending. Actions now pending before Congress indicate similar Congressional concern for this national objective. Some of the actions to reduce spending in oceanic and atmospheric activities in the several agencies were taken with reluctance, in recognition that there would be some adverse effects; others because programs had been rendered inefficient by the advent of replacement technologies. I do not believe that any programs of overriding national importance have been sacrificed. However, the concerns of NACOA are noted, and those pinpointed will be reviewed to determine whether some restoration should be made in fiscal year 1975 and beyond.

The Committee's concern about the adequacy of the oceanographic fleet to meet the national needs and its more general concern about the adequacy of the capital structure for all marine and atmospheric sciences warrants investigation. In the case of the oceanographic fleet, it appears that the reduction will be less than 18 percent as contrasted with the 25 percent cited by the Committee. However, the capital structure problem is of sufficient importance to warrant a special study, and I have asked the Chairman of the Federal Council for Science and Technology to undertake this study through the appropriate interagency committees.

NATURAL RESOURCES AND MARINE AFFAIRS

The Committee's view is that the management of land, water and atmospheric resources is so closely related that they should be organized into a single Federal agency at the departmental level. The President's proposal for establishment of a new Department of Energy and Natural Resources (DENR), which will achieve this end, is now before Congress. The Committee's rationale coincides with that of the President.

The approval by the Congress of the President's proposal will, among other effects, bring about the loss of the National Oceanic and Atmospheric Administration (NOAA) to the Department of Commerce. I have grown to have a deep appreciation for oceanic and atmospheric activities during my tenure as Secretary of Commerce. It is, therefore, with some sadness that I view the prospect. However, I believe it is in the national interest that the President's proposal be quickly endorsed by the Congress and that the DENR

be brought swiftly into being. We need management mechanisms that will allow us to deal more effectively with our overall energy and natural resource problems, and we need them now. NOAA will be an essential element of the new Department.

While the Committee's endorsement of the President's proposals is basic and overriding, it is concerned with what it sees as the lack of attention given to the role of the oceans in the proposal for the DENR. I wish to assure the Committee and the Congress that the Administration attaches great importance to oceanic and atmospheric affairs. In recognition of this, President Nixon has proposed that ocean, atmosphere and earth science and service activities be organized into one of the five major elements of the new DENR.

The Committee has also provided suggestions for possible organizational alignments within the new DENR. Organizational structures and their functions lend themselves to an infinite variety of permutations as pointed out by the Committee. The President's proposal does not include transfer of such major organizations as the Coast Guard from the Department of Transportation or the Maritime Administration from the Department of Commerce, etc., to the new DENR. While recognizing that these organizations are involved in oceanic functions, the Administration believes that the adverse impact on the Nation's transportation, safety, and commerce functions would outweigh the benefits to be derived from their consolidation within an "oceanic" organization. Similarly the advantages of the Committee's proposals to separate the Maritime Administration from its research and development functions and to split up both the National Marine Fisheries Service and the Bureau of Sport Fisheries and Wildlife would be outweighed by the inability of these organizations to provide responsive foci for their areas of activity.

It is the intention of the Administration to join NOAA and the U. S. Geological Survey (USGS) within DENR. Enormous benefits and new strength will be added to the oceanic and atmospheric functions of NOAA and the earth functions of the USGS. At some later date, additional functions can be considered. At that time, the suggestions of NACOA will be given further consideration.

The Committee has recommended the designation of an appropriate official of the Navy, such as the Oceanographer of the Navy, as Federal Coordinator for marine technology development. I strongly support the need for Federal coordination in all areas of governmental activity where many agencies are involved. In the

case of marine technology, however, we already have a mechanism within the Federal Council for Science and Technology, namely, the Interagency Committee on Marine Science and Engineering (ICMSE) which is dealing with this problem and on which the Navy and other agencies are represented. The outstanding capability of the Navy in ocean engineering has been and will continue to be of great value to the Nation's civil ocean engineering programs, and this use should be more extensively encouraged.

The concern of the Committee for the national effort in ocean engineering is appreciated. I agree that ocean engineering is a key to broad scale ocean development. One of the more difficult questions, however, is the extent to which the Federal Government should engage in and support civil ocean engineering activities. I believe that the Committee could provide help in the formation of the Nation's ocean engineering effort by undertaking a comprehensive study of the national needs and the appropriate role of the Federal Government in meeting them. I have asked the Chairman of NACOA to undertake such a study.

ENERGY AND THE OCEANS

I have studied with great interest the Committee's views on energy and the oceans and the vital role of the oceans in meeting the energy needs of the Nation.

The Committee correctly points out that the most promising way to increase our domestic discovery rate for oil and gas is to intensify exploration and drilling offshore on the continental margins of the United States. The President has recognized this imperative in his recent energy message in which he directed that the rate of leasing of offshore lands be tripled. A leasing schedule designed to fulfill this directive has been issued.

The problem of safeguarding the environment while developing the Nation's offshore oil and gas resources is a major concern of the Administration. I agree fully that there is no basic inconsistency in developing the Nation's oil and gas resources while retaining a quality environment. The technology needed to accomplish this objective is under development and for many purposes already available. In meeting our energy needs, we must continue to insure that the necessary scientific and environmental knowledge is available so that decisions can be made with all factors known. The Committee points out that one of the top priority Government

functions must be to establish the environmental norms and the environmental support services for the necessary oil exploration offshore. Such environmental services must include forecasts of weather and sea states and ocean currents, as well as provision of biological background information which can be used for making assessments of oil contamination. The Committee feels that these activities must be accompanied by periodic monitoring. I agree that this is a proper role for the Federal Government. We intend to provide the necessary ocean monitoring and ocean forecasting support.

The President has directed that, under the leadership of the Council for Environmental Quality, a comprehensive environmental study be undertaken of the possible impacts of oil and gas development along the Atlantic and Alaskan coasts. This study will be completed in April 1974. In addition, the President has forwarded legislation to the Congress providing for the certification of the environmental safety of deep-water ports. This should insure that our environmental objectives are not compromised in the process of meeting our energy needs.

One of the most interesting aspects of the Committee report is its assessment of the national need for deep-water terminals and deep-water ports. Without question, as the national dependence upon foreign crude oil increases, the United States will need facilities to accommodate tanker traffic, traffic that will involve ships of massive size, up to 500,000 dead-weight tons. Studies, sponsored by various agencies of the Federal Government including the Maritime Administration, are underway on issues such as those raised by the Committee report. In addition, the Administration has proposed legislation (S-1751, H.R. 7501, Deep-Water Port Facilities Act of 1973) to authorize the Secretary of the Interior to regulate the construction and operation of deep-water port facilities.

The Committee has also stated its concern about the difficulty in obtaining approval of sites which satisfy economic and environmental criteria for the construction of major new refineries. While it is true that environmental concerns may have deterred some companies, it is noteworthy that since the removal of crude oil import restrictions on May 1, 1973, several oil companies have decided to expand existing refinery capacity. This expansion will provide a total increase of 10 percent in our national capacity. However, the issue raised by the Committee is a crucial one. It involves the manner in which we balance our economic and en-

vironmental needs. My view is that we must insure a balanced approach to this problem. It is a topic on which the advice of the Committee is most welcome.

Similarly, the Committee has discussed the problem of siting new major power plants. The Administration believes that this is also a critical matter. It has proposed legislation (S-935, H.R. 4874, Electric Facilities Siting Act of 1973) which will provide long-range regional planning for bulk power facilities within Federal guidelines. The purpose of the legislation is to meet national power needs while reasonably protecting the environment, conserving natural resources, and planning the proper use of available land. This legislation will provide decision-making agencies with procedures for achieving a publicly acceptable balance of these competing objectives.

The siting of nuclear power plants on bays and tidal rivers is a special problem. There is a need to minimize thermal pollution. Such thermal pollution is more readily accommodated in deeper water than it is in the shallow and biologically sensitive estuarine and near-shore area. I feel, therefore, that the Committee's recommendation for new approaches to coastal siting, particularly the possibility of offshore siting of nuclear plants, warrants serious consideration.

MANAGING THE COASTAL ZONE

NACOA expressed concern about the delay in funding the Coastal Zone Management Act, passed by the last Congress, and signed by the President into law as Public Law 92-583. Since the delivery of the report to me, the Administration announced on 1 August that an amendment to the President's fiscal year 1974 budget would be submitted to fund the Coastal Zone Management Act. This has been done. Five million dollars have been requested to implement the provisions of the Act.

The Administration has always regarded the management of the coastal zone as being a matter of great importance. It had felt, however, that a period of more extensive planning was required before funding of the coastal zone management activities could take place. It has started to work with all of the coastal states and has now issued, in draft form, guidelines for the development of coastal zone management programs. These were published in the *Federal Register* on June 13, 1973.

In a related action the Administration sent to the Congress its proposals for a national Land-Use Policy Act. One of the concerns of the Administration is that efforts to manage the coastal zone are compatible with more general land-use management activities. Favorable action by the Congress on a Land-Use Policy Act is vital for concurrent implementation of both of these programs. The formation of the proposed DENR will enable the establishment of closely coordinated programs for both land and coastal zone management.

ATMOSPHERIC ACTIVITIES

The Committee has followed its excellent special report on the effectiveness of the Nation's hurricane warning system in connection with Hurricane Agnes of last year with a summary of its views on improvements that are required in the short-period disaster warning systems. I agree with these views wholeheartedly. The President's 1973 and 1974 budgets provided substantial increases for facilities, personnel, and equipment required to bring about the kinds of improvements proposed by NACOA for the Nation's disaster warning program. Although much remains to be done to implement the NACOA proposals, these increases will provide for improved geostationary satellite systems which will give us views of small-scale weather phenomena, increased computer capacity which will allow us to deal in a physical/numerical sense with much smaller scale phenomena than we have hitherto, and incremental improvements in the communications and automated observation systems recommended by the Committee.

The Administration agrees fully with the Committee that local communities must prepare themselves to take action when severe weather or floods threaten. To insure that the most efficient use is made of these improved disaster warning systems, the Administrator, NOAA, and the Director, Defense Civil Preparedness Agency (DCPA), have recently entered into a formal agreement between the two agencies to work together toward more effective community preparedness.

We are pleased that the Committee regards the NOAA program for automation of field operations and services (AFOS) as being an important activity which can bring about the introduction of modern technology into the forecast and warning process. By using advanced communications and display technology for modernizing

weather station operations, we will be able to cut the response time of the warning system significantly and to increase the reliability of the transmission and dissemination of warnings. Prototype development of the AFOS system is moving ahead rapidly. A Model Facility to demonstrate the feasibility of the concept is now under contract.

It is my intent to continue to support the kinds of programs that are recommended by NACOA in order to insure that this Nation has the best warning system that our technology can provide.

The Committee, once again, has raised the issue of the technical content and the organization of the Federal Government in the field of weather modification. It expresses its concern that the weather modification programs of the Federal Government have been declining in funding, and management of these programs has become even more diffuse. It has again recommended that NOAA be established in the lead role for carrying out certain Federal weather modification activities. We interpret the Committee's advice as not precluding the need of agencies such as the Departments of Transportation, Agriculture, Interior, and Defense and the National Science Foundation from carrying out operational and research activities closely related to their missions.

One of the benefits of the establishment of the DENR will be to permit new opportunities for more effective planning, coordination and management of weather modification activities of the Departments of Commerce, Interior, and Agriculture. As a result, technical progress should be accelerated.

The Committee's concern with the decrease in the funding available for research in the field of weather modification is appreciated. For certain aspects, however, there have been substantial increases in the Nation's weather modification activities in the President's budget request for fiscal year 1974. These increases are mainly for capital equipment, principally heavy research aircraft equipped with modern instrumentation. For some time we have been concerned about the growing and critical obsolescence of the equipment available for weather modification activities. We have taken the decision this year to place the greatest emphasis on modernizing the capital equipment structure underlying the Nation's weather modification program. This action reflects the Committee's concern for the general state of the capital structure in oceanic and atmospheric affairs and strengthens our research capability.

Essential to the national weather modification effort is the kind

of basic science support funded by the National Science Foundation. This research over many years has contributed much to our present-day understanding and technology. The present program of weather modification research in the National Science Foundation will assist operational responsibilities of various agencies, including those to be incorporated into the DENR.

The Committee has reiterated its concern, expressed in the first annual report, for the public policy issues as well as the legal, social, and economic impacts of weather modification. Studies, sponsored by the National Science Foundation and the Departments of Interior and Commerce, are now underway to provide information on these vital aspects of weather modification.

FISHERIES ACTIVITIES

The Committee has again emphasized the predicament of the U. S. commercial fisheries. This situation daily grows more serious. I share the Committee's concern for the need to insure an economically healthy fishing industry in the United States. During the past year, we have taken some important steps and we are pleased to see their endorsement by NAC/OA. I am especially gratified to see the Committee's strong support for passage of the High Seas Conservation Act submitted by the President to provide a basis for improved management of our coastal fisheries; and, secondly, its support for the new State/Federal management program which the Department of Commerce is fostering cooperatively with coastal states.

During the past year, I have directed that we take a much stronger position in our international fisheries negotiations in order to protect and conserve the resources on which our fishermen are dependent for their livelihood. I am sorry to report that at the last meeting of the International Commission for the Northwest Atlantic Fisheries, the nations which fish off our East Coast were unwilling to reduce their total effort. I have indicated that we will reconsider our membership in that Commission if, through it, the necessary conservation of our fishery resources cannot be achieved.

The Committee again raises the issue of a national plan for use of the national fishery resources. I agree that a longer range plan is required, and I have directed the Administrator of NOAA to formulate such a plan.

Mr. DOWNING. Without further delay, I would now like to call on Dr. William A. Nierenberg, chairman, NACOA, to take his place at the witness table, and to bring with him such other committee members as he may desire.

I see that you are accompanied by Dr. Douglas L. Brooks, executive director, National Advisory Committee on Oceans and Atmosphere, and the following members of your committee:

Dr. William J. Hargis, Jr., vice chairman, NACOA, director, Virginia Institute of Marine Sciences; Dr. Dayton H. Clewell, senior vice president, Mobile Oil Corporation; Mr. Thomas A. Fulham, president, Suffolk University; and Dr. Thomas F. Malone, director, Holcom Research Institute, Butler University.

Before you begin your testimony, Dr. Nierenberg, I would like to say to you and other members of your committee that the subcommittee appreciates your appearance this morning, and further appreciates the outstanding manner in which your Advisory Committee has obviously been operated.

While I regret the delay in discussing with you your second report, I believe that a discussion of that report and your subsequent activities can serve as an excellent beginning for the subcommittee as it looks in the weeks ahead to hearing detailed discussions from various departments and agencies as to their programs.

This series will continue on Friday, March 29, when we will have the privilege of hearing from Dr. Robert M. White, administrator, National Oceanic and Atmospheric Administration, and members of his staff, in relation to the programs of that Agency.

And now, Dr. Nierenberg, you may proceed as you see fit.

Mr. MOSHER. Mr. Chairman, can I interject one comment?

Mr. DOWNING. Yes, indeed.

Mr. MOSHER. Your excellent statement says that the question now is whether there has been adequate advancement looking toward the focus on ocean problems.

I think I would like to comment that I do not think there is any such thing as adequate advancement. I am sort of an impatient soul. If there is any implication there that what advancement there has been we can be content with it, I think we should not accept that.

Mr. Chairman, I think we should be impatient, and not content and not feel that anything is adequate. At the same time I must say that I have been pleased with NACOA, and so I am delighted, along with the chairman, that you gentlemen are here to testify before us.

Mr. DOWNING. I quite agree with the gentleman.

Let me say here that whether there has been adequate advancement is something we could look into.

Again, I want to thank you gentlemen for making the trip here to give us the benefit of your judgment in this important field.

Doctor, before you begin, has there been a change in your Board of Directors?

STATEMENT OF DR. WILLIAM A. NIERENBERG, CHAIRMAN, NACOA, DIRECTOR, SCRIPPS INSTITUTE OF OCEANOGRAPHY; ACCOMPANIED BY DR. DOUGLAS L. BROOKS, EXECUTIVE DIRECTOR, NATIONAL ADVISORY COMMITTEE ON OCEANS AND ATMOSPHERE, AND THE FOLLOWING COMMITTEE MEMBERS: DR. WILLIAM J. HARGIS, JR., VICE CHAIRMAN, NACOA, DIRECTOR, VIRGINIA INSTITUTE OF MARINE SCIENCES; DR. DAYTON H. CLEWELL, SENIOR VICE PRESIDENT, MOBIL OIL CORP.; THOMAS A. FULHAM, PRESIDENT, SUFFOLK UNIVERSITY; AND DR. THOMAS F. MALONE, DIRECTOR, HOLCOMB RESEARCH INSTITUTE, BUTLER UNIVERSITY

Dr. NIERENBERG. Yes, sir, there has been.

Mr. DOWNING. Do you have a list of the new members, so we can place it in the record?

Dr. NIERENBERG. Yes, I brought it with me.

Mr. DOWNING. Without objection that list will be made a part of the record at this point.

[The list referred to follows:]

NATIONAL ADVISORY COMMITTEE ON OCEANS AND ATMOSPHERE, WASHINGTON, D.C.

NACOA MEMBERSHIP

(*—New member).

Dr. William A. Nierenberg, Chairman, Director, Scripps Institution of Oceanography, P.O. Box 1529, La Jolla, California 92037.

Dr. William J. Hargis, Jr., Vice Chairman, Director, Virginia Institute of Marine Sciences, Gloucester Point, Virginia 23062.

Dr. William C. Ackerman,* Chief, Illinois State Water Survey, Box 232, Urbana, Illinois 61801.

Tim M. Babcock,* Senior Executive Vice President, Occidental International Corporation, 1717 Pennsylvania Avenue, N.W., Washington, D.C. 20006.

Charles F. Baird, Senior Vice President, International Nickel Company of Canada, Limited, One New York Plaza, New York, New York 10004.

Perkins Bass, Sheehan, Phinney, Bass, and Green, Peterborough, New Hampshire 03458.

Robert F. Bauer,* Chairman of the Board, Global Marine, Inc., 811 West 7th Street, Los Angeles, California 90017.

Dr. Wayne V. Burt, Associate Dean of Research (Oceanography), Department of Oceanography, Oregon State University, Corvallis, Oregon 97331.

Dr. Robert A. Charpie,* President, Cabot Corporation, 125 High Street, Boston, Massachusetts 02110.

Dr. Thomas A. Clingan,* Interim Dean, School of Law, University of Miami, Coral Gables, Florida 33124.

Dr. Charles L. Drake, Professor of Earth Sciences, Dartmouth College, Hanover, New Hampshire 03755.

Thomas A. Fulham, President, Suffolk University, 41 Temple Street, Boston, Massachusetts 02114.

Brig. Gen. J. J. George, USAF (Ret.), Director of Meteorology, Eastern Airlines, Box 787, International Airport Branch, Miami, Florida 33148.

Arthur Godfrey, Arthur Godfrey Productions, 59 E. 54th Street, Suite 81, New York, New York 10022.

Dr. Charles L. Hosler, Jr., Dean of Earth and Mineral Sciences, Pennsylvania State University, University Park, Pennsylvania 16802.

Edwin A. Link,* Harbor Branch Foundation, RFD 1, Box 194, Ft. Pierce, Florida 33450.

Harold E. Lokken,* Manager, Fishing Vessel Owners Association, Inc., Room 207, Pier 59, Seattle, Washington 98101.

John W. Luhring, 1510 Sandpiper, Palm Desert, California 92260.

Dr. Thomas F. Malone, Director, Holcomb Research Institute, Butler University, Indianapolis, Indiana 46208.

Dr. Arthur E. Maxwell, Provost, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543.

Lt. Gen. Thomas S. Moorman,* USAF (Ret.), Executive Vice President/Programs, Air Force Academy Foundation, Inc., P.O. Box 1838, Colorado Springs, Colorado 80901.

Dr. Donald B. Rice, President, Rand Corporation, 1700 Main Street, Santa Monica, California 90406.

Clement Tillion, Alaska House of Representatives, Pouch V, Juneau, Alaska 99801. (Address from January through June 1); Hallbut Cove, Via Box 3733, Homer, Alaska 99603. (Address from June 1 through January 1).

Dr. Winona B. Vernberg,* Research Professor of Biology, Belle W. Baruch Coastal Research Institute, University of South Carolina, Columbia, South Carolina 29208.

Elmer P. Wheaton, Vice President, Lockheed Missiles and Space Company, P.O. Box 504, Sunnyvale, California 94088.

Mr. DOWNING. You may proceed.

Dr. NIERENBERG. Mr. Chairman, I am very grateful for your remarks. We do appreciate them very much. This has been a very hard working committee, one of the hardest working I have been associated with, and we are deeply grateful, and I am speaking on behalf of all of my colleagues in NACOA and myself expressing our appreciation for the privilege of reporting to you today on our activities.

Our appreciation is deeper than these conventional words might suggest.

This subcommittee, and the full committee of which it is a part, have since the late 1950's provided such farsighted and effective leadership in the progress toward a national ocean program that it is not an exaggeration to say the present program is to a large part your creation.

I have in mind such milestones as the establishment of the Interagency Committee on Oceanography in 1960 at least partly in response to concern expressed by this committee, the extended hearings in 1965 on more than 20 bills aimed at defining and implementing national ocean policy, the passage of the Marine Resources and Engineering Development Act of 1966, and the fact that virtually all significant developments on the national scene since have flowed rather directly from this act.

I refer, of course, as you did, to the products of the two interim bodies established by the act, the Cabinet-level National Council on Marine Resources and Engineering Development and the Commission on Marine Science, Engineering and Resources. Perhaps chief among these products is the Commission's seminal 1969 report, *Our Nation and the Sea*, whose recommendations, backed by this committee, led to the establishment of such programs as the International Decade of Ocean Exploration, known as IDOE, and the Coastal Zone Management Act, and to the establishment of two organizational successors to the Council and the Commission; namely, the National Oceanic and Atmospheric Administration (NOAA) in 1970 and NACOA in 1971.

Since NACOA's assignment is to assess the Nation's oceanic and atmospheric activities, reporting to you today on our conclusions is in a rather fundamental sense saluting your work and its results.

But there is much more work still to be done. The resources of the sea in oil, gas, minerals, and food hold out both promise and threat to an increasingly resource-hungry world. The promise is that marine resources can relieve some of the pressure on thinning terrestrial supplies. The threat is that this relief is only temporary.

The realization that this is so could in the absence of informed statesmanship precipitate a "rule or ruin" effort among the nations of the world, dangerous not just to the participants but to the resources themselves and to the environment of which they are a part and on which they depend.

Recent or pending legislation initiated by the Merchant Marine and Fisheries Committee on marine mammal protection, ocean dumping, and seabed mineral development testify to your awareness of the on-going challenge to the capacity of this country to manage its marine and environmental affairs and to participate effectively in international efforts as well.

The challenge to our Nation's management of its marine and atmospheric resources is the theme of our second annual report, and the subject of our testimony before you today. To develop this subject, I have brought a number of my colleagues on NACOA with me today.

With your permission, I should like to introduce them now.

First, Dr. Douglas L. Brooks, our executive director, will discuss the chapter in our report entitled, Natural Resources and Marine Affairs. It is this chapter that addresses the question of Federal organization for ocean resources management that has already been referred to.

Second, Dr. Dayton Clewell will discuss the chapter on energy and the oceans. Dr. Clewell, as you know, is senior vice president of Mobil Oil Corp., and president of Mobil Research and Development Corp.

He is here above and beyond the call of duty. He went off the board this year—we have a rotating 3-year term for NAOCA—but Dr. Clewell was a very important factor in the preparation of this of our chapter, and he very graciously gave us this day to be here and help us in this presentation.

Third, Dr. William J. Hargis, Jr., director of the Virginia Institute of Marine Sciences and vice chairman of NACOA, will discuss the chapter entitled, Managing the Coastal Zone. Dr. Hargis is well known to this committee.

Mr. Chairman, let me interject a light remark. He is really distinguished, and I make a point of saying it, because I have only recently come to calling my colleagues distinguished. My unaccustomed, northern courtesy has become developed by close association with my southern colleagues.

Then I have my old friend, Dr. Thomas F. Malone, director of Holcomb Research Institute at Butler University in Indiana. He will discuss the chapter on atmospheric activities. Although your committee does not have nominal oversight over atmospheric matters, the Stratton Commission made a persuasive case for their intimate and reciprocal connection with many aspects of marine affairs, and you wisely made this a NACOA responsibility when you drew up our

statute. Dr. Malone is an outstanding authority in the fields of atmospheric science and public policy, and we are fortunate indeed to have him on NACOA.

I think in his presentation he will emphasize the growing importance of keeping a very close relationship between oceanic affairs and atmospheric affairs.

Next, Mr. Thomas Fulham, president of Suffolk University in Boston, will review our chapter on fisheries activities. As you can see from the brief biography which you have been provided, Mr. Fulham has been involved in fisheries matters for a long time.

In fact, he has been involved in fisheries affairs and matters since before he was born. It goes back in his family.

Further biographical information on all of these people has been provided to you, and I refer you to it rather than take more time for introductions now.

I should add one point, though, not so much for you, as for the record. The speakers today are not speaking for themselves or the institutions from which they come. They are in fact speaking for NACOA, which stands collectively behind the positions taken in our report.

I would propose, with your permission, to turn to these speakers at this point. Each is prepared to speak for approximately 10 minutes on his subject, and I will possibly end up with a few summary remarks.

We intend to cover the key recommendations in the report, mention major developments or absence of developments since the report was written, now almost 10 months ago, and perhaps comment on what may lie ahead.

We are all prepared to be interrupted by questions or comments from the committee, and in fact to proceed however you wish.

If you have any comments now, I shall be happy to receive them, otherwise we will proceed with Dr. Brooks.

If you have any comments we will be happy to receive them.

Mr. DOWNING. Thank you very much.

If it meets with the approval of the committee, I suggest we let each speaker go ahead and follow each other, and then we will ask questions later.

Dr. Brooks, you may proceed.

Dr. Brooks. Mr. Chairman, members of the committee, I am very pleased to be here with Dr. Nierenberg and other members of NACOA to discuss with you today NACOA's thinking on Federal organization.

Reorganization is a means to an end, not an end in itself.

NACOA's recommendations for reorganizing the Federal effort in marine and atmospheric affairs came after the committee encountered problems attributable to fragmented and narrow-scope management, not before. You will be hearing about some of these in specific areas from other speakers. Let me mention a few that they will not.

First, NACOA encountered considerable ambiguity with regard to national policy. The 1966 Marine Resources and Engineering Development Act contains an excellent declaration of national policy regarding a "coordinated, comprehensive, and long-range national program in marine science."

NACOA was looking for a declaration of national policy regarding the objectives and conduct of marine activities considered more

broadly than just marine science. That is, it looked for policy guidance regarding marine resources, their development and conservation, marine transportation, marine recreation, and their joint regulation in the interests of environmental protection, our international obligations, and the mutual compatibility of the various uses of ocean space themselves.

NACOA did, of course, find signposts pointing in this direction in the report of the Stratton Commission and in the statement in the 1966 act that created it concerning the national objectives to which marine science should contribute.

But it became clear that these signposts had, in many important respects, been ignored.

In particular, there was nothing that could, in good conscience, be called a truly national program in marine affairs from which a coherent national ocean use strategy or de facto policy could be inferred.

Among the evidence of loss of focus, NACOA found that the annual report of the President to the Congress on the Federal Ocean Science Program and its adequacy required by the 1966 act has diminished in substance and timeliness, as well as influence, since the demise of the Marine Sciences Council.

And the last time the President's budget carried a special analysis of this "Federal Ocean Program" was in fiscal year 1971. Since then, the program components are included in the budget only as parts of their agencies' programs, most of which have nonoceanic purposes.

The most immediate spur to NACOA's concern was the sudden and unprecedented OMB budget cuts in mid-fiscal year 1973.

When the committee probed into their impact on marine and atmospheric programs, it found two things:

First, the cuts had, in general, been made carefully and with considerable thought to minimize the immediate first-order impact on programs.

Second, they raised serious questions about their second-order effects and their medium- and long-range impact.

For example, six Coast Guard ocean station vessels were to be deactivated, three immediately and three the following year, at the same time that NOAA's ocean-buoy program was cut back and reoriented from a national program to one aimed at merely meeting NOAA's requirements.

These programs could have been considered complementary and scheduled for phaseout and phase-in, in a complementary fashion. They were not.

A second worrisome consequence of the budget cuts was a major reduction in the ocean research fleet.

A third was the decision not to fund NOAA's new coastal zone management program.

This evidence of suboptimizing agency programs without careful regard to their relationship to some overall national ocean strategy looked to us particularly worrisome for the future.

Offshore oil, minerals, food, greatly increased shipping, the demand for more and deeper ports and terminals, and the prospect of wholesale changes in the rules of conduct of marine affairs in the law of the sea could not, we felt, be managed piecemeal or as mere extensions of their terrestrial counterparts.

The committee knew that at this time the administration was about to submit legislation to reorganize the Federal effort in natural resource management, including the management of marine resources.

We did not have the administration's bill at the time. It appeared a month after our report was finished, but we did have available to us the extensive document called "Papers Relating to the President's Departmental Reorganization Program."

When the bill H.R. 9090 did appear, it resembled the material we had available to us in the Presidential papers and, therefore, to save time, let me discuss our recommendations in the context of that bill which is still the current administration statement about its intent in energy and natural resources reorganization.

I think the committee's position can be summed up most succinctly in two statements:

First, the committee agreed to support the concept of a greater centralization of natural resource management.

Second, however, when it came to look into the details of the bill, the committee felt that the terrestrial resources and management and jurisdictional concepts were overly dominant.

NACOA sees four major deficiencies in the present bill.

First is the lack of a suitable marine affairs policy statement. Such a statement is needed to draw attention to the uniqueness of the problems of marine resources management and to give a fresh impetus to the policy statement in the 1966 Marine Resources Act.

A second deficiency is the inadequacy of the statement regarding the functions to be carried out by the DENR to implement marine affairs policy.

The desired functions recommended by NACOA can be stated in great detail, but the gist can be briefly summarized as:

1. Encouraging the development and conservation of marine resources and other uses of the coastal and marine environment.
2. Coordinating and regulating these activities for environmental, economic, multiuse conflicts, and international reasons; and
3. Providing technical, engineering development and scientific services that cut across agency and departmental lines, including surveys, environmental monitoring, prediction, and control, as well as basic scientific and engineering knowledge.

The third deficiency is the failure to specify which functions will be the responsibility of the Marine Affairs Administrator and which will not. This leaves unresolved the question of where the present program in coastal zone management, fisheries, sea-grant, and marine law enforcement will go, as well as who will have responsibility for the new function of marine multiple-use coordination.

NACOA recommends that all except the function of marine law enforcement be assigned to the same administration, and that the law enforcement function be independent and at the administrator level.

Finally, NACOA notes the omission of certain transfers to the department required to carry out these functions. One of these is the Coast Guard. Another is household support of NACOE itself.

The report and our subsequent communications to Secretaries Dent and Morton also draw attention to present programs and activities that should be considered together when such a department is established. But, NACOA's ideas are not rigid here.

The reason is that these groupings by themselves cannot assure the successful execution of the functions already discussed.

The functional approach is the essential feature, and the formal agency groupings should follow as means to this end.

Perhaps the basic point here is that though NACOA regards the DENR concept with favor, generally speaking, it is concerned with it primarily as a vehicle for implementing national ocean policy along the lines discussed above.

Lacking a suitable DENR, the committee would turn to some other vehicle for this purpose. Among the alternatives would be some existing department, perhaps, and most certainly an independent agency.

In conclusion, NACOA feels that to obtain the best use of the Nation's oceanic, coastal, and environmental resources, responsibility for their management should be given a more central focus. This need is urgent and getting more so all the time.

If it can be properly achieved by the establishment of a DENR, well and good. If not, it should be brought about some other way.

NACOA hopes that your committee, Mr. Chairman, will continue its long and fruitful leadership in marine affairs and contribute its efforts to such an important task.

Thank you, sir.

Mr. DOWNING. Thank you, Dr. Brooks, for an excellent statement.

Dr. NIERENBERG. Next we will hear from Dr. Clewell.

Dr. CLEWELL. Mr. Chairman, the oceans must play an increasing role in the supply of energy for the United States. This is especially true for the next 15 years.

In this interim period, demand for energy will, of course, continue to increase.

In 1971, about 75 percent of our energy came from oil and gas of which 65 percent came from domestic sources.

By 1980, it has been estimated that only half of our petroleum supplies can be met from domestic sources.

The shortfall can, to some extent, be made up from imports, but recent events have certainly dramatized the insecurity of reliance on this solution.

In the long run, U.S. supply of energy is adequate. Coal is in plentiful supply, and even if it were to supply all of our energy, it could do so for many decades, 100 years maybe. But we also have oil shale and tar sands and, in the very long run, solar and nuclear sources.

However, because of the tremendous investments and related lead times required for the development and construction of facilities to utilize these unconventional sources of petroleum, we cannot count on significant production from them for 10 or 15 years.

In the meantime, our energy shortage can be minimized by:

(1) Increasing our petroleum discovery rate with special emphasis on offshore drilling.

(2) Importing more foreign crude and natural gas.

(3) Increasing the percentage of oil recovered from known reservoirs.

(4) And, of course, working to control demand by adopting energy conservation measures.

The oceans will play a very important role in the first two of these actions.

Speaking of the first one, offshore oil and gas:

The Outer Continental Shelf of the United States is estimated to have recoverable hydrocarbon resources of upward of 160 billion barrels of crude oil—four time proven reserves at year end 1972—and upwards of 800 trillion cubic fet of natural gas—three times proven reserves at year end 1972.

The continental slope probably has an equal amount in addition to these. Production has already been established offshore Louisiana, Texas, California and Alaska.

To determine for a fact that this petroleum reserve does exist, we must accelerate leasing very substantially.

Working in the ocean poses different environmental problems from those onshore.

In addition to being entirely under Government jurisdiction, the ocean supports a complex and varied mix of activities—fishing, shipping, recreation, and defense, in addition to the exploitation of petroleum and mineral resources.

Harmonizing all these operations is no easy matter. In addition, all these operations have an impact on the ocean environment.

Environmental concerns have in the past few years greatly slowed down lease sales not to mention construction of refineries and nuclear power plants along our coasts.

NACOA believes that striking a balance between energy and ecology is one of the most important problems facing the Nation. In the ocean, the problem is accentuated—the water moves and pollutants are rapidly spread so that pollution caused by one activity soon has an impact on all other activities.

A top priority function of Government should be to establish norms in the offshore area and to provide forecasts of sea-states, currents, biological background and chemical pollution sources.

Such norms and forecasts are essential to setting pollution control and siting regulations. Once the norms and the forecast methodology are established, periodic monitoring should be maintained to recognize changes and to help determine whether they are caused by nature or by industrial activity.

In either case, regulations should be reviewed and changed, if necessary, to maintain a practical energy/ecology balance.

Referring to the second item, deep water terminals:

Eventually, we may become completely self-sufficient in energy supply. The capability of self-sufficiency is desirable even if we never apply such capability 100 percent of the time.

But, in the short term, we will need to import petroleum. It is essential, therefore, that we have deep water facilities to offload large tankers needed to handle the anticipated tonnage safely and economically over the next critical 15 years.

Here again, the ocean plays an important role since NACOA believes that deep water oil terminals are an attractive alternative to dredging present ports.

Most of the deepwater facilities built around the world, some 100 of them, use single point moorings, SPM, and provide a capacity for a 24-hour turnaround for any size tanker.

The United States has none, even though three are under active consideration—one near Freeport, Tex.; another near Grand Isle, La., and one off Delaware.

NACOA recommends that as a quick fix the United States have at least one operational SPM in the Gulf of Mexico by 1976 and one off the east coast by 1978.

Siting of facilities:

Siting is a problem for energy-related facilities. Terminals associated with imports or offshore development must be in the coastal zone.

Other facilities, such as refineries and powerplants, can be located elsewhere, cooling water availability and reasonable access to the consumer makes the coastal zone attractive. But the coastal zone, as is increasingly evident, is attractive to many other uses, not all of which are compatible.

It is natural to want facilities such as big power plants, refineries, et cetera, located far from where one lives, and some have suggested that in order to avoid building more, we simply curb our demands for energy. There is no question that conservation and efficiency should be a vital part of our national energy policy and that reducing demand would buy some time.

In our report, we stated that the projected energy demand would grow at the rate of between 3.4 and 4.4 percent per year and that electrical power itself at a rate of 7 percent.

These rates are probably too high since they are a continuation of past trends.

Some estimates are now put at 2 percent per year for growth in energy demand. But, even so, the siting problem for new plants will still be with us.

Nuclear powerplants are destined to be an increasingly important factor. Today, there are 39 in operation, 55 under construction, and 90 more on order.

By the year 2000, nuclear plants will provide half of our electrical generating capacity.

Cooling water is essential for all powerplants, nuclear or coal-fired.

In general, for every unit of electrical energy generated, two units are discarded as waste energy. This waste energy must be dissipated somewhere.

Water is ideally suited as an absorption medium and since ocean water is so vast, the oceans again are the logical place to dispose of the heat. The temperature rises are at a minimum and, hence, environmental impacts will be at a minimum.

Again, we are back to the problem of an energy-ecology balance.

To sum up, NACOA feels that a national objective of our ocean program should be to have the technology and environmental information in hand such that decisionmakers can judge the consequences of proceeding with offshore oil and gas development, as well as the placing of new energy-related facilities safely and economically in offshore waters.

In short, progress does not have to mean a degraded environment. If properly done, we can have both the needed energy as well as an improved environment.

NACOA stresses the need for increased emphasis on improved ocean technology on the part of industry and Government in support of their respective responsibilities.

Thank you.

Mr. DOWNING. Thank you very much, Dr. Clewell.

Your next witness, Dr. Nierenberg?

Dr. NIENBERG. We will now hear from Dr. William J. Hargis, Jr., Vice Chairman, National Advisory Committee on Oceans and Atmosphere.

Dr. HARGIS. Mr. Chairman, I am Bill Hargis, Vice Chairman of NACOA since its inception and director of the Virginia Institute of Marine Science. My task is to comment on the status of the developing national coastal zone management program.

Need for improved and better coordinated management of the vast resources and environments of the coastal margins of the Nation and its 30-odd coastal States, commonwealths and territories, has been recognized for almost a decade.

A number of groups—including the Commission on Marine Science, Engineering and Resources—COMSER, the Stratton commission—the National Council on Marine Resources and Engineering Development—the Council—and the Committee on Merchant Marine and Fisheries—have recognized the long term importance of this vital area as has NACOA.

Because of these well-established needs, NACOA urged passage of specific legislation to establish an effective national coastal zone management program in its first annual report to the President and the Congress. In fact, we supported specific legislation, something unusual for groups of this type.

Such legislation was passed and became law in October 1972—Public Law 92-583. We are pleased to have contributed to passage of this landmark State-Federal resource-use program.

Unfortunately, funds for the authorized coastal zone program were not provided straight away. NACOA's next efforts—Second Annual Report to the President and the Congress, page 24—were devoted to an attempt to secure funding to enable starting the program.

The Congress also took great concern in this unexpected turn of events. The net result of these pressures was that a \$5 million supplemental budget for fiscal year 1973 and \$12 million of fiscal year 1974 funds were made available.

The House Committee on Merchant Marine and Fisheries, especially members of this subcommittee, the Subcommittee on Oceanography, and its staff were prime movers in this effort and deserve praise.

It should be recorded that the Department of Commerce, through NOAA, has given support to the program since original passage of the legislation.

During the early period, NOAA devoted internal funds to establish the Office of Coastal Zone Management, now the Office of Coastal Environment. This action enabled building of internal program capabilities within NOAA and development of needed procedures and guidelines.

This foresight has minimized the overall program impact resulting from the funding delays. NACOA has been favorably impressed with these efforts.

NOAA—that is, NOAA's Office of Coastal Environment—under the able and dedicated direction of Robert W. Knecht, has developed a staff competent to the task ahead.

Several developmental studies have been conducted, and guidelines for planning grants have been developed, commented on, and issued.

Proposed Guidelines and Procedures for the Marine and Estuarine Sanctuaries portion of the program were published in the Federal Register on March 7, 1974.

Since specific funds were first made available in mid-fiscal 1974, progress has been substantial.

In fact, the first three planning grants to the States of Rhode Island, Oregon, and Maine were awarded by Secretary Dent at the Coastal Zone meeting at Charleston, S.C., on March 13, 1974.

Not only has the Federal Government gone forward with its part of the program, but the States have also been active. At least 17 States have already passed legislation related wholly or partially to planning and management of the coastal zone, and some 28 have notified NOAA of their intention to seek approval of planning programs in the next several months.

The current funding related specifically to the coastal zone management program—Public Law 92-583—is as follows:

In fiscal year 1974, \$800,000 has been allotted to start up and internal planning, \$7.2 million to coastal zone planning, section 305, and \$4 million to the sanctuaries procurement, section 312.

We have been informed that \$12 million has been requested by the Executive for fiscal year 1975, of which \$9 million will be for section 305, and \$2.1 million for administration grants, section 306.

NACOA is pleased that significant moneys are beginning to flow into the program and out to the States.

We are disappointed that funding was not begun earlier and that it is not yet reached the levels authorized in the act.

Realizing that authorizations beyond the ability of the system to effectively utilize them would be unwise and wasteful, NACOA stresses the importance of an expeditious buildup to the full authorized funding levels. The tasks involved in effective coastal zone management are so vital and of such magnitude as to require rapid action.

Additionally, they impinge upon most every one of the areas that are critical to the country today, that is energy, environment, and the economy.

Because of the great importance of this program, both to the health and well-being of the oceans, adjacent land masses and people, NACOA intends to monitor closely the progress of the program.

While continuing its review of the planning and management phases of the national coastal zone program and of the sanctuaries program, NACOA is now in the process of reviewing the requirements for research, technology and advisory services needed to assure maximum success of the planning and management phases.

A number of activities are involved, such as the national sea grant program of NOAA, the RANN program of NSF, and various relevant efforts in the Departments of Interior, HEW, DOD, et cetera.

We will then compare these needs with relevant State and Federal programs now in being. Should shortcomings be detected, it is our

intention to convey these findings to the Congress and the Executive in our third annual report, due June 30. Where possible, specific recommendations for action will be provided.

I would like to insert a few remarks here.

Apropos the specific problems before the committee, the question is, has there been adequate advancement in the coastal zone management of the United States.

The answer has to be a qualified yes.

I have already cited what NACOA thinks of the progress that has been made. Under difficult circumstances, NOAA has done reasonably well. Due to the delay in funding, progress has been somewhat delayed and somewhat slow, and there is some question as to the adequacy of research and development effort.

However, we do anticipate that with the funding requested and the interest of Congress, the national coastal zone management program will go forward and make good progress.

The committee is concerned in *the* of the coastal zone—the resources and environs of the coastal zone, as well as other aspects of the national oceanic and atmospheric program with what will happen in the various executive and legislative reorganizations that are under consideration and may be effected.

We urge, as you have heard from Dr. Brooks, that oceanic and atmospheric affairs remain together and receive the focus that they deserve in whatever reorganization is accomplished. This specifically relates to the coastal zone management program. It also relates to science and engineering as well as management-oriented activities. It is important that not only the management and planning phases reside within the same department or agency of the department, but also the research and development aspects.

As it goes into its third year, NACOA, itself a creature of the Congress, looks forward to continuation of the effective working partnership with the Congress and especially with this committee.

Mr. Chairman and committee members, my thanks for this opportunity to discuss the developing coastal zone management program with you.

Mr. DOWNING. Well, thank you, Dr. Hargis.

Dr. NIERENBERG. I think Dr. Malone will be our next witness to testify.

Dr. MALONE. Mr. Chairman and members of the committee, I am Tom Malone.

With your permission, I will summarize the highlights of my testimony, which you may see fit to insert in the record, and it will carry us along a little faster.

Mr. DOWNING. Without objection, your full statement will be inserted in the record at this point.

[The statement referred to follows:]

STATEMENT OF DR. THOMAS F. MALONE, MEMBER, NATIONAL ADVISORY
COMMITTEE ON OCEANS AND ATMOSPHERE

Mr. Chairman and members of the committee, perhaps it would be most helpful if I were to identify four subject areas in which recommendations were made by NACOA in its Second Annual Report and make some comments on the present state of affairs in those areas. They are:

Small-scale meteorological phenomena (floods, tornadoes, hail, etc.) which have large local impact;

Acceleration in the application of communications and automated technology in the delivery of weather forecasts;

Weather modification; and

Climatic fluctuations.

In its Second Annual Report, NACOA recommended "that greater attention now be paid to the problems created by weather and environmental phenomena . . . that are . . . small or medium scale, geographically limited, short-lived, and exceptional in the sense of being at the time both hazardous and infrequent in any one spot. We are referring to flash floods, tornadoes, severe hail storms, pollution "hot spots," sudden crop-damaging freezes, and short-term fluctuations in phenomena of great importance to operations, such as airport ceilings and visibility, and anomalous wave-heights at harbor entrances, near shore and at sea." I am pleased to be able to report that planning has been initiated on a meso-scale research experiment which will place particular emphasis on severe storms in the midwestern part of the United States where their frequency is rather high. Present thinking is that an area something like 150 miles on a side would be instrumented with about a hundred ground stations, twenty radiosondes and several Doppler radars. The experimental design is being developed at the NOAA Environmental Research Laboratory in Boulder with the collaboration of university scientists and meteorologists at the National Center for Atmospheric Research. In support of these field studies, the Committee on Atmospheric Sciences of the National Academy of Sciences is exploring techniques for the detection, monitoring, and prediction of short-lived phenomena as well as the matter of public warnings. Reports are expected this summer and the experimental field program should get underway during 1976 and 1977. This will not be an inexpensive undertaking, but the annual toll taken by severe storms and tornadoes is sufficiently great that a major national effort should be mounted.

With respect to the application of modern technology to the delivery of weather forecasts, we are pleased to note that the AFOS (Automation of Field Operations and Services) is moving ahead on schedule with prototype testing expected this spring. The importance of this program rests on the fact that it will speed up the delivery of weather warnings and free the forecaster from routine tasks and permit him to concentrate on those activities which require judgment and creativity. Here again sizable expenditures are going to be required over the next few years. But if we are to improve the utility of weather forecasts and match the technological progress of operations of field offices with that at the large meteorological centers a major capital investment program will be necessary.

For two successive years, NACOA has remarked that "we stand on the threshold of a new era in environmental control," and has made wide range and specific recommendations with respect to:

Institutional arrangements intended to correct the fragmentation, lack of focus, and subcritical size of the present program that is divided among several Federal agencies. We urged a national program with clearly defined goals, objectives, priorities, allocations of resources and procedures for evaluating and measuring progress.

Legislation to define the rights and responsibilities of individuals, the several States, and Federal agencies as well as providing badly needed regulations and procedures under which the Federal government and its employees may legitimately modify the weather.

Research and technology designed to strengthen the knowledge base upon which rainfall-augmentation activities depend.

Research and development on the technology to mitigate the effects of hurricanes, including a proposal to move Project STORMFURY from the Atlantic to the Pacific.

Issues of public policies to clarify several critical questions which remain unanswered, such as: Who benefits from weather modification? Who loses? Is weather modification the best way of dealing with problems it is intending to solve? Are there unintended ecological side effects or consequences?

International agreement and institutional arrangements to eschew the hostile uses of weather modification.

I am sorry to report that progress in this area has been considerably less than satisfactory. True, a sizable capital investment is being made to bring up to

date the instrumentation of aircraft to be used in Stormfury when it is reactivated and some modest legislation has been passed requiring the reporting of weather modification activities to the Secretary of Commerce. But our National program still suffers from the deficiencies that have been pointed out from a series of reports extending over the past eight years. In fact, ground has actually been lost during the present fiscal year.

A new urgency now supports the recommendations that NACOA has made on weather modification over the past two years. Events of recent months have served to underscore the need to increase world-wide agricultural productivity. In a substantive sense, we are confronted with the task of increasing food production by 4 percent per year over the balance of this century. In an economic sense, the market value of farm products has reached levels that sharply alter the benefits to cost ratios that are the goal of efforts to augment rainfall. The evidence at hand is suggestive, although not conclusive, that rainfall over agricultural areas could be increased by one or two inches during the growing season. The importance of such augmentation to agricultural output makes a compelling case for definitive experiments to remove any ambiguity over the effects of cloud seeding over agricultural areas. As an illustration of what is going on at the present time, a midwestern state will carry out rainfall augmentation operations over 60 percent of its area this summer with the goal of increasing rainfall by one or two inches while substantially decreasing the possibility of damaging hail. This program has a cost of about \$1 million, with three-quarters being underwritten by the state and one-quarter by the counties. The anticipated benefits to cost ratio is ten to one. It requires no great imagination to envision the problem that would be encountered if programs of this kind were mounted in several adjacent states. It is clearly time for the Federal government to take prompt and positive action.

There is no response to the NACOA recommendation that our government take the initiative in establishing international agreement that all modification efforts be dedicated to peaceful purposes. Here there would seem to be an excellent opportunity for the Congress to take a statesmanlike and constructive position.

The final topic I would like to address briefly this morning relates to the attention NACOA drew in its Second Report to the importance of understanding the physical basis of climatic change. The disastrous effects of unfavorable changes of climate in sub-tropical latitudes on food production has sharply focused world attention on the impact of either natural or man-made climatic fluctuations on worldwide food production. In addition, the disturbing possibility has been raised that the likely increase in energy production over the next 50 to 100 years might perturb atmospheric circulation in such a fashion as to induce possibly unacceptable changes in global climate. NACOA is interacting vigorously with several groups of scientists now seeking to formulate a national program on climate change and we plan to say more about this in our Third Annual Report.

As a footnote to the mention of the climatic problem, it is relevant to point out that any satisfactory understanding of climatic change will require a major advance in our understanding of oceanic circulation and the transfer of heat between the oceans and the atmosphere. In this sense, it was with great prescience that the Congress saw fit to combine the study of ocean and atmosphere in a single agency. New dimensions of interrelated atmospheric and oceanic research will unfold as we seek to unravel the mystery of climatic fluctuations.

Mr. DOWNING. You may proceed, sir.

Dr. MALONE. May I say that NACOA is one of the more gratifying of the dozens of committees I have served on in Washington.

I get the impression when we pick up the telephone to say something to the Congress or the executive branch, there is always someone there to listen. That gives us a sense of accomplishment.

Now, in our report, we hit on four major recommendations. The first was for sharply focused attention on the small-scale meteorological phenomena—the tornadoes, hail, thunderstorms, floods, and things of that kind.

I am pleased to be able to report that planning has been initiated on a small-scale research experiment which will place particular emphasis

on severe storms in the Midwestern part of the United States, where their frequency is high and their toll is devastating.

At present, the thinking is that an area something like 150 miles on a side will be equipped with 100 ground stations, 20 radio stations, and several radars. The experimental design is being worked out by the NOAA Environmental Research Laboratory in Boulder, Colo., in close collaboration with the National Center for Atmospheric Research and some of our universities.

The Academy of Sciences has several committees working on this matter. Their report should be out this summer, and some field activities should begin in 1976 or 1977.

Our second major recommendation was with respect to accelerated application of modern technology to the delivery of weather forecasts, and we are pleased to note that what has been called AFOS, the automation of field operations and services, is moving ahead on schedule with prototype testing expected this spring.

The importance of this program rests on the fact that it will speed up the delivery of weather warning, and free the forecaster from routine tasks, permitting him to concentrate on those activities which require judgment and creativity.

Here, sizable expenditures will be required over the next few years, but the forecaster is swamped with paperwork at the present time, at the forecast office, and we think this is an excellent program.

Our third major recommendation had to do with the matter of weather modification. I might remark that for 2 successive years NACOA has asserted that we stand on the threshold of a new era in environmental control, and we have made wide ranging and specific recommendations with respect to institutional arrangements, legislation, research and technology on rainfall, research and development on hurricanes, the issue of public policies and international agreements.

I am sorry to report that here progress has been considerably less than satisfactory.

Our national program still suffers from deficiencies that have been reported out from a series of reports extending over the past 8 years.

In fact, I would say that ground has actually been lost during the present fiscal year.

It is important to recognize that there is a new urgency that supports the recommendation that NACOA has made on weather modification over the past 2 years. Events of recent months have served to underscore the need to increase worldwide agricultural productivity. In a substantive sense, we are confronted with the task of increasing food production by something like 4 percent per year over the balance of this century.

In an economic sense, the market value of farm products has reached levels that sharply alter the benefit to cost ratios that are the goal of efforts to augment rainfall.

The evidence at hand is suggestive, although not conclusive, that rainfall over agricultural areas can be increased by one or two inches during the growing season, and this would have a major impact on the yield. I have the details in my written testimony on some of the steps that are being taken by the States, and I would hope that the Federal Government would respond to this grassroots movement, be-

cause it is a matter that transcends the boundaries of individual States.

As a footnote to this discussion of the inadequacy in weather modification I would remark that there has been no response to the NACOA recommendation that our Government take the initiative in establishing international agreements that all modification efforts be dedicated to peaceful purposes.

If I had to sum up the single greatest need, it is for enabling legislation which will define national purpose, national goals, programs and methods of evaluation.

The final topic that we treated in our report has to deal with climatic change, understanding its physical basis.

The recent disastrous effects of unfavorable changes of climate in the subtropical latitudes on food production has sharply focused world attention on the impact of natural or manmade climatic fluctuations on worldwide food production.

I might say, as an aside, Mr. Chairman, I was in Africa a few weeks ago where I saw hundreds of carcasses of animals that had starved to death. There was something like 200,000 people about to starve to death in Africa alone this year, and it is not prophecy of doom to point out the stark possibility that we may be faced with the prospect of millions of people starving to death in this decade.

This need not be, but we must address this question of the impact of large-scale climatic change on food production.

I would finally point out here, and this supports the remarks of my colleagues, that here again taking proper account of the inextricable link between the ocean and the atmosphere becomes imperative, and it was with great foresight that the two fields were embraced in a single agency NOAA.

I have remarked on many occasions that the matter of climatic change is probably more of an oceanic problem than it is an atmospheric problem, because it is the ocean that is the flywheel that sort of keeps the atmosphere spinning. We are just on the verge of being able to work quantitatively with ocean currents, ocean temperatures, and I share Mr. Mosher's sense of urgency that we now get on with this program.

We are going to address this in more detail in our third report which will be out this summer.

Thank you, Mr. Chairman.

Mr. DOWNING. Thank you, Dr. Malone.

We will now hear from Mr. Thomas A. Fulham, another member of the National Advisory Committee on Oceans and Atmosphere. He is also president of Suffolk University in Boston.

Mr. FULHAM. Thank you, Mr. Chairman.

Mr. Chairman and members of the committee, my name is Thomas A. Fulham. I am president of Suffolk University in Boston, Mass., but for the major part of my working life have been involved in commercial fishing.

I appreciate the opportunity to appear before you on behalf of the National Advisory Committee on Oceans and Atmosphere, on which I am serving my third year.

I have also served with ICNAF, the International Commission for Northwest Atlantic Fisheries, and a number of other Boards and

Commissions in connection with living marine resources. I mention this only because I wish to give weight to my statement that I have found NACOA deliberations and activities with regard to fisheries matters particularly helpful, and, as I shall enlarge on briefly below, a stimulant to a national rather than a parochial approach to fisheries problems of the United States.

Only by a national approach do I believe we can find the essential means to halt the abuse of the fishery resources and the decline of the U.S. participation in its harvest.

You may recall that in its first annual report NACOA spoke to the need for a national program in fisheries which would provide a coherent rather than a piecemeal guide for fisheries efforts. Such a plan would offer the hope that we can as a nation reverse the continual decline in the share furnished by U.S. fishermen of fishery products consumed in the United States.

At the same time, a national approach to the management of the fishery resource would be provided to counter the threat of continuing blindly the damage we have seen done to species after species of fish previously abundant in the oceans.

In fact, it was the recognition by all segments of the fishing community—and this only quite recently—of the threat to the natural resources itself which made it possible to look for a common management approach. The approach could, in turn, create an environment in which private investment and private initiative could begin rebuilding where rebuilding is needed and grow stronger where things are in better shape. But the chapter on fisheries of the first annual report is in the record. I will dwell on it no longer here.

I would like to report to you briefly on its reception.

What that first chapter provoked was a lot of discussion. What we wanted to provoke was action. Yet this proved to good purpose.

In that discussion we found out where we were misunderstood, and we found out where we misunderstood others. So we went right back to it in our second annual report. NACOA found there that fisheries problems were piling up faster than the solutions.

Even though such steps as the pending high seas fisheries bills and the National Marine Fisheries Service State/Federal Management program were welcome progress in laying the groundwork for the species approach to coastal fisheries management, unless a national planning effort were undertaken, it did not seem to us to be possible that anyone would know where to put the effort which would do the most good.

Overview planning, which has hardly been the hallmark of fisheries efforts in the past, at least in this country, is what was needed.

NACOA therefore went into somewhat more detail on our understanding of the need to relate biologic, economic, and enforcement aspects of fisheries management, none of which alone could solve fisheries problems.

Further, we recognized the need for equitable international enforcement of conservation schemes without which no conservation or utilization measure could be effective, and the absence of which, in addition, often penalized our fishermen in comparison with foreigners.

We stated in our report that an "atmosphere for redevelopment" to give fisheries the chance to succeed would mean a plan taken with due

regard to the need to view fisheries as part of our national wealth which we must husband; conservation by biologic, and economic, and enforcement means as a necessary consequence; and the need to give higher priority to protection of coastal and high seas fisheries, especially as regards differential enforcement of fisheries regulation compared with other nationalities.

NACOA therefore recommended passage of high seas fisheries bills such as H.R. 4760 and S. 1069, development of a national plan by the Secretaries of Commerce and Interior, international agreements incorporating mechanisms for conservation of stocks on which U.S. fishermen depend with "greater awareness of problems of international enforcement," and continued support of the species approach in the coming Law of the Sea Conference.

In response to the recommendation for a national plan, Secretary of Commerce, Frederick Dent, responded by directing the Administrator of NOAA to formulate such a plan.

Dr. White, the Administrator, has formed a task force with sufficient permanent staff dedicated to this single purpose to give us assurance that a major effort is being made.

It would be inappropriate for us to comment on the status of the work underway by this task force, although I am happy to report that liaison is close.

Mr. Tillion and I, both of NACOA, and a number of members of the Marine Fisheries Advisory Committee, form a committee advisory to this task force. There is a continuous close contact between the task force and NACOA staff and interagency representation has been developed.

We are also happy to report that we have been informed that every effort is being made to develop a cooperative exchange and development of pertinent fisheries information with the Department of the Interior so that the plan, which perforce will emphasize the marine fisheries, since it is within the Department of Commerce, will nevertheless have had sufficient information made available to it so that interaction with freshwater and sportmen's resources be taken into account.

I close this brief account of NACOA's work to stress my personal satisfaction that after years of divisive argument amongst fishermen about the many matters which keep them apart, we are at last coming to the point of tackling our common problem—the threat to the fisheries themselves—with the belief that once their healthy existence is assured by proper conservation measures, commercial and recreational health and well-being will be a natural derivative.

The fact that NACOA, which has numbered amongst its members representatives of coastal, pelagic, freshwater, and anadromous fisheries, and both industry and labor, can have agreed to a common emphasis, may itself be a good omen.

Thank you.

Mr. DOWNING. Thank you very much.

Now, Dr. Nierenberg, you say you have a few words to add?

Dr. NIERENBERG. I think I would like to pass them, Mr. Chairman, in the interest of saving time.

I know you will have many questions you will put to us, and that would be more fruitful than any summary I would make at this time.

Mr. DOWNING. All right, sir.

I think that this has been an excellent summary of your report, and the committee wants to thank all of you. I know they are pleased that at least you think there has been, in Mr. Mosher's words, adequate advancement.

I have a few questions.

Dr. Clewell, you brought up an interesting proposition, not new, of course, but of an energy-ecology balance.

Where does the leadership come from to establish this balance?

Dr. CLEWELL. Well, I guess at this time there really is no agency that is established to try and have the balance.

I think, of course, the Environmental Protection Agency is a group that is very much interested in making sure we protect the environment.

On the other hand, we have other agencies in the Government that are interested in developing our resources, for example, the Department of Interior in connection with oil and gas.

I look upon NOAA as perhaps an agency at the present time that feel some responsibility, and I think are doing a certain amount of work in terms of establishing what are the norms, what are the conditions that exist now in the oceans, so that we have some basis to measure whether the environment is getting worse or better in the oceans.

Here is sort of a fact-finding or a science or a technological group that is trying to establish what the normal situation is.

Then you have the other groups that are interested in exploiting certain resources of the oceans, and others trying to protect them.

I do not feel that there is anyone that is really responsible in terms of coming up with an energy-ecology balance. But I still think it is something that we need in this country. It is where we are having an awful lot of conflict.

Perhaps a strengthening of the coastal zone management program is where it could take place, because to me that is what coastal zone management means—how do we accommodate all of these different activities in the ocean, especially in the coastal zones?

There is where I believe the judgments would have to be made as to what is the right balance.

Mr. DOWNING. Thank you very much.

Dr. Brooks, you are not entirely satisfied with the provisions which are contained in the Department of Energy and Natural Resources insofar as oceanic matters are concerned, and you have made certain recommendations.

Have those recommendations been passed on to the committee which is handling this legislation?

Dr. BROOKS. Yes, in the Senate, Mr. Chairman, at the request of Senator Ribicoff.

We have not received such a request from the House committee, but have made available substantially that same information to your staff, for example, informally.

Mr. DOWNING. The general thrust of your recommendation is that there is no centralized agency responsible for these oceanic activities, is that it?

Dr. BROOKS. That is precisely the keystone of our recommendation, that there should be a greater focus, and greater centralization of the various responsibilities for the various uses of the seas, including, I

might just point out to you, the establishment of an appropriate balance between energy and ecology, which Dr. Clewell just mentioned.

That question of striking a balance between all the various uses of the sea is one of the functions which we feel is missing in the Federal structure at this point, and we do recommend that it be a function assigned to the DENR, if the DENR is to do its job in the area of our concern.

Mr. DOWNING. Thank you.

Dr. HARGIS, you were one of the responsible parties for the coastal zone management bill, and you say you are satisfied with the progress we have made so far commensurate with the funding?

Dr. HARGIS. Yes.

Mr. DOWNING. Did you say that there are some 17 States that have adopted coastal zone management?

Dr. HARGIS. There are probably more than 17, but there are at least 17 that have either acted on a broad scale coastal zone management program, or on narrower portions of coastal zone management, and the States that have been involved in this, of course, range all the way from Florida on the one hand to Oregon on the other, and from California and Maine, and Virginia has enacted legislation which covers some segments of the coastal zone.

We—Virginia and the other States—look forward to utilizing the planning money to develop more comprehensive plans for management of the coastal zone.

Mr. DOWNING. Thank you.

Dr. HARGIS. If I might comment, Mr. Chairman, along the lines of the question that you put to Dr. Brooks, the committee, NACOA, has placed such emphasis on the question of reorganization of the Federal Government to cover effectively atmospheric and oceanic affairs, specifically reorganization of the executive on the one hand, and the proposed reorganization of the legislative on the other hand, that we have a continuing review of this activity, and I think it is reasonable to say that there will be, as a result of the continuing review, some more specific comments made in the next annual report relative to the current status of the various organizational proposals.

We are very much concerned with how Congress addresses itself to its own reorganization.

Mr. DOWNING. Thank you very much.

Dr. Malone, did your office predict that 7 inch snow that dropped on Norfolk, Va., yesterday? I did not see anything in the paper about it.

Dr. MALONE. We are careful not to invade the territory of Virginia, sir. I am happy to say.

Dr. NIERENBERG. Mr. Chairman, I just say this close association between the atmospheric scientists and the oceanographers is very recent.

We predict in time they will do much better as this association develops.

Mr. DOWNING. That is encouraging.

Let me ask you a question about weather modification, Dr. Malone. How is it accomplished?

Dr. MALONE. The most widely practiced form of weather modification is seeding of clouds with silver iodide, which tends to accelerate and augment the rain process in those clouds, and the indications are

that under certain conditions the rainfall can be increased, say on the order of 20 percent. Under other conditions, when overseeding is practiced, it is possible to decrease the rainfall. This is the most common practice.

The one that is now being studied quite seriously is the injection of silver iodide into hail clouds. This has the tendency of causing hail to fall as small, soft particles, rather than large hail stones, and decreases the damage to crops.

Those are the two most widely practiced.

A third one that has a limited application, but is probably the most successful, is the clearing of supercooled fog over airports; that is, fog which exists in the water stage at temperatures below freezing. It is possible to dissipate that fog and resume air operations.

Those are the three most common practices.

Mr. DOWNING. Have you determined what the legal consequences of that are?

Dr. MALONE. No, sir, this is a matter which we feel needs to be addressed, and this is why we feel that it is timely that the Congress take this matter up.

There have been some suits in court, and there are opposing views.

One point of view says that the law will be determined by the court decisions. The other says that there are legislative acts which should be put in force now to designate the kind of responsibilities to provide the kind of indemnity which is going to be necessary if this practice spreads.

Personally, I believe that legislation is needed to clarify this.

Mr. MOSHER. Will the gentleman yield?

Mr. DOWNING. Of course.

Mr. MOSHER. Mr. Malone, I notice on page 6, you are very discreet when you refer to a Midwestern State. You do not name it. I suppose this is a very delicate matter, because one man's rainfall is a blessing, and to his neighbor it may not be a blessing; and this is implied, of course, by the comment you make about the legal aspect.

Does NACOA feel it necessary not to name the Midwestern State? I do not want to embarrass you, and force you to name it.

Dr. MALONE. There is no embarrassment, sir. It is no classified matter. It is the State of South Dakota.

In the State legislature they have a rather vigorous program going there.

Mr. MOSHER. This is widely known among the people of the State and their neighbors, and it has not become a legal matter?

Dr. MALONE. Yes, sir, it is widely known, and generally supported within the State.

As one who lived 20 years in South Dakota, when the State puts up \$1 million to conduct an experiment like this, I know it means there is a pretty strong support for it.

I do not know what the Minnesotans, or Nebraskans, or the people in Wyoming are going to think about this, however.

Mr. MOSHER. There is no way you can cut this experiment off at the State line, I assume?

Dr. MALONE. No, sir.

Mr. DOWNING. Mr. Fulham, I appreciate what you had to say about conservation and management.

Is not the determining factor in that theory, the presence of foreign fishing fleets lying off our coasts that are draining the resources?

Mr. FULHAM. You are quite right, Mr. Chairman, but one of the postulates of the national planning effort is that the United States would secure control over the living resources of the Continental Shelf, and we anticipate that through the Law of the Sea Convention, or by our own activity, that we will do just that.

Mr. DOWNING. I have attended several international conferences on the subject, and I am convinced it is going to have to be our own unilateral action if we are going to get a rollback of the fisheries jurisdiction.

Mr. FULHAM. You are quite right.

Mr. DOWNING. Mr. Mosher?

Mr. MOSHER. Mr. Chairman, I suggest these six reports really are blessedly brief and concise, and I think remarkably useful. They raise a lot of questions, and stimulate a lot of thought.

I will not pretend to ask what might be the real priority questions. But I would like to pursue a little bit further with Dr. Hargis the discussion of the question of the responsibility of the States.

You say at least 17 States have already passed legislation, and I will reveal my own parochial interest, what about the Great Lakes States?

Dr. HARGIS. Actually, as you are almost certainly aware, action has been taken by several of the fourth sea coast tier of States.

There is considerable interest in Michigan, Wisconsin and Ohio, and I think each has passed some legislation, some a little broader than others.

There is a fairly good summary of some of this activity in the first volume of the new journal, the *Journal of Coastal Zone Management*, which has just come out, and if you like I could send you a copy.

Mr. MOSHER. I would like to see that.

Overall, is the response of the States sort of spotty, or is there unanimity of the enthusiastic response, or is it spotty?

Are there some States that are seriously lagging? You do not need to name them, of course.

Dr. HARGIS. I did comment that there are undoubtedly more than 17 that have taken action. There has been some disparity in action from the broader concepts that have been taken in connection with Proposition 20 in California, or the Oregon development versus Virginia, for example, which has already had some coastal-related management program on the books, and recently enacted what it calls the wetlands management program, a State wetlands management program.

There is some disparity, and that is one of the things that NACOA pointed out in our second annual report, that the absence of funding of the programs that you, the Congress, authorized, was counterproductive in that, as a result of the lack of national guidance and funding, we were not getting the uniform response to the national legislation throughout all of the States. There has been action. It has not been uniform, and we are looking forward to the next phase of the national coastal zone management program to bring in uniformity.

I think it is safe to comment, Mr. Mosher, however that the States

have been almost unanimous in their urging the development of the program.

Mr. MOSHER. What about the adequacy of the proposed budget for fiscal year 1975?

If I remember correctly, that was another \$12 million. The fact that you propose only \$12 million, is that going to be a discouraging factor?

Dr. HARGIS. I think—my own personal opinion, and I have not cleared this with the Committee—is that there should be more funds available for the next phase than are projected. I do not know at this point how much of the current \$12 million will carry over into 1975.

Mr. MOSHER. But you suspect \$12 million is not adequate to keep the momentum up?

Dr. HARGIS. Yes, sir.

And I am particularly concerned that more is not able to be allocated to the management phase—which one would expect to lag behind the planning phase—but there is considerable management already undertaken by the States and to the sanctuary programs.

Mr. MOSHER. Mr. Chairman, I do not want to hog the time but I have to go to a Rules Committee meeting.

May I ask a technical question?

Mr. DOWNING. Surely.

Mr. MOSHER. Dr. Clewell, at the bottom of page 5, you emphasize that cooling water is essential for all powerplants.

I have been impressed with what I have heard. I do not pretend to be technically competent, sir, but I have been impressed with what I hear about high temperature gas cooled reactors and the potential there.

If we could develop those, would that relieve this need for vast quantities of cooling water to any extent?

Dr. CLEWELL. Well, no, I do not think there is any connection there.

The high temperature gas cooled reactor is a process they use within the reactor itself to keep the uranium fuel cool, but eventually that heat has to be dissipated somewhere. And so it does not make any difference whether it was a gas cooled reactor itself or whether it was a water cooled reactor, or what have you.

The eventual dissipation has to be somewhere in the atmosphere.

Mr. MOSHER. I suggest that you review that. I understood that a main argument for it is the fact that it does not require anywhere near the amount of water cooling, and it is a tremendous advantage.

Dr. CLEWELL. Well, it is a more efficient reactor and, therefore, it converts more of its energy into electricity, I would say, because of the higher temperature it operates at.

But there is still another advantage—less dissipation into the water and into the atmosphere.

Dr. NIRENBERG. Just to make a comment.

You are involved with the second law of thermodynamics here that even Congress has not been able to tamper with.

It is a rough rule of thumb that, while nuclear energy has very good environmental factors, at least in some minds, in its rejection of heat, it is about a factor of two poorer than conventional hydrocarbon plants up till now.

It means you are going to reject quite large amounts of heat with either a conventional plant or nuclear plant. And what I would call a

conventional nuclear plant is twice as bad in this connection as a conventional hydrocarbon plant.

However, you can make a nuclear plant more efficient by operating it at higher temperatures. That is precisely the advantage.

But, nevertheless, the change, the orders of magnitude, the future amounts of heat that have to be dissipated are so great that you are still left with the environmental problem of getting rid of the heat.

You can reduce it somewhat by a more efficient plant, but our power demands are so great and, curiously, the environmental requirements are such that not only is this dissipation required because of the second law, but we are moving in a direction, and this is something implied in Dr. Malone's remarks, we are moving in the direction of very large concentrated powerplants instead of many small dispersed ones.

There are good reasons for doing this, but this can cause the rejection of this waste heat.

On an efficient basis, you can raise local problems that can be very serious, particularly if the rejection is done through the atmosphere directly.

Mr. MOSHER. Thank you, Mr. Chairman.

Mr. DOWNING. Mr. Rogers?

Mr. ROGERS. Thank you, Mr. Chairman.

Mr. Chairman, I too, have enjoyed the presentation. It has been very helpful.

What response have you seen from the executive branch to your recommendations?

For instance, has the Secretary of Commerce done anything about Storm Fury in this kind of research?

Dr. MALONE. Mr. Chairman, I can cite one instance where we recommended that the aircraft engaged in Storm Fury, that is trying to ascertain whether or not a hurricane can be modified, be moved to the Pacific and the program strengthened.

The program was halted. They are making a substantial investment in the instrumentation of these aircraft, and we feel that here is one of the bright spots where the executive department did respond to a specific recommendation.

Mr. ROGERS. Well, I do not know that I share that feeling that they responded very well, as I inspected the operation in Miami, and it had ceased everything.

We have been set back perhaps 1, 2 or 3 years, as a result of the termination.

In fact, the Director and his wife, who headed the program, resigned because they were so upset about the cavalier attitude in which research in this area had been carried out and supported.

I take it from your statement you are very much concerned about this, and I notice you specifically mentioned it, which I am glad you did.

In other words, I hope you will emphasize these areas, and you have, but I hope in a very sustained way. Mr. Chairman, and other distinguished colleagues of the committee, it is going to take all of us to do the job, as you, Mr. Chairman, have pointed out very well.

Dr. NIENBERG. I asked Dr. Malone to respond to your specific question about Storm Fury.

You also have the general question, and you know it is always difficult, the answer is yes and no.

Mr. ROGERS. Of course.

Dr. NIERENBERG. Let me put it this way.

I tried to keep score as to how many of our recommendations are genuinely picked up by the Congress or the administration as we make them.

Now, for a committee of this kind, I think our record has been phenomenal.

Mr. ROGERS. I agree and I think you have done an excellent job.

Dr. NIERENBERG. It comes out that an average of about 60 percent of our specific recommendations have been adopted.

I could enumerate many of them—the engineering question and fisheries question are treated very seriously. But, you know, that is an unweighted average. These are all important things.

The fisheries question is certainly very important. The engineering question is certainly very important, and so on.

It is an unweighted average, and I think there is a feeling that you are probably getting from our presentations, that the big question still keeps eluding us. And that is to say the question of who is in charge of the central overall management of the national oceans program, which we do not have.

In other words, this is the recommendation that we have not been able to sell for a variety of reasons, and that is one of the 40 percent that has not yet gone. And, of course, it is a very important one.

So the answer is yes, our specific recommendations have been treated extremely well and very seriously, but some of our recommendations to which we ascribe the highest importance just do not seem to move.

Now, on the question of organization, of course, there is some difficulty because events are changing so very rapidly in the world—and I am not trying to be pragmatic about this.

While we did endorse the DENR, still we would like to see the recommendations carried out in whatever framework the Congress or the administration sees as appropriate, but this framework seems to be changing—I mean, from listening to the debates in Congress, listening to the pronouncements of the Executive and the changing world conditions, we have considerable difficulty in approaching this problem.

On the question of Storm Fury, I could add something perhaps of a more general nature.

We had difficulty in trying to ascertain which was the most important reason for the delay in the program. One of them, of course, was the question of locale.

One of the problems has been, of course, the restrictions placed on the investigators as to which storms they could work on and which storms they could not with regard to possible changes in the path of the storm.

You are aware of this, I know, Mr. Rogers. I think one argument that was presented was that by moving the entire operation to an appropriate place in the Pacific, the return on the investment in a statistical sense would be more rapid.

On the other hand, one hears these things and then you wonder is it also a budgetary stretchout.

It is always easy to rationalize a budgetary stretchout with a very sound scientific argument. It has been very difficult for us to determine.

All I can say is, as Dr. Malone said, we are gratified, even though there has been a delay, that the program apparently is picking up.

That is the best one can say at this time, Mr. Rogers.

Mr. ROGERS. I appreciate that response, and I do feel it was budgetary without question in my own mind.

This is our problem in all of the development of the oceans, and I am not so much concerned now about reorganization as I am about the funding to let the current agencies do something that they are willing to and that they have the capacity if we can just get in the funding. And, of course, that is our problem, too, for us to get enough support to really give them some money to work with and some facilities, and we know where they ought to be working, and you have pointed out, I think, probably one of the most critical areas is weather modification, control of weather, and what we can do.

And as you say, with the food situation as it is in the world, for us not to do this in a reasonable way is unbelievable.

I would hope this committee, Mr. Chairman, can do something about encouraging greater funding in research in this whole weather modification.

I think we need to get ahead of Russia in this, and they are moving rather rapidly.

I know when I was in Russia some years ago, I think they put in a weather modification man as the head of Oceanography in Moscow. I think he is still there.

Dr. NIERENBERG. Monin. He is a first-class atmospheric physicist.

Mr. ROGERS. So I hope we will not get too far behind.

Thank you very much for the fine work you are doing for the country and certainly for this committee and the Congress.

Mr. DOWNING. Mr. Forsythe?

Mr. FORSYTHE. Thank you, Mr. Chairman.

I would like to join my colleagues in commending you for these statements this morning. Everything that is said in them, I think I support.

Dr. Clewell, I would like to come back to your concern regarding the balance of energy and ecology. This is certainly one of the hottest issues that we are involved in at this particular moment in time.

I agree with you when you say that the progress does not have to mean a degraded environment, but how to do this is the question. In this regard I think you referred to perhaps even the coastal zone management machinery as perhaps the proper mechanism.

I wonder if you agree what we need is to maintain as much as possible an independence in any Government structure?

In the environmental protection function, in a sense, you have to have the adversary situation with those who are as I am concerned about developing energy. And if we were to go into a third bureaucracy, the problem becomes commensurately more complex.

Dr. CLEWELL. Well, you are raising a problem which, of course, is extremely fundamental.

Actually, I think the people of the United States will make the balance decision eventually. Lots of time when we underrate their-

ability to make a decision, once they have a pretty good feel for what the pluses and minuses are on the whole thing, they react wisely.

I would feel it is not a matter of having a Czar set up somewhere, or that we are going to have a bureaucracy under him, to make the decisions all to himself as to what is the right balance, because the balance might change from time to time.

I feel, however, that some place, probably in the executive branch of the Government, there should be a place where, when it comes to talking about the interference of various activities in the ocean with each other, that somebody in a regulatory capacity is going to have to make some decisions as to what the regulations will be or what regulations he would recommend to Congress if it were legislation to be passed, and so on.

It is that man who is going to have to have all the information possible.

I think right now we are a little bit too emotional about some of these things. Somebody is saying we have got to have energy, and the other fellow is saying we have to have a better environment.

As you well know, you cannot have 100 percent of both. You have to have a little bit of compromise there. But still any decision is going to have to be made on the basis of very, very good information as to what the pluses and minuses are on both sides.

And also I feel that NOAA should have a big role in determining what the background values are that we started from and where we are today.

Mr. FORSYTHE. I think I fully agree with you.

My concern was this third bureaucracy idea. I hope that was not quite what you meant, that we did not need this third bureaucracy.

Dr. CLEWELL. No; I did not have that in mind, another bureaucracy.

Mr. FORSYTHE. I agree there is no zero risk to the environment, and I agree there can be no degradation of the environment without concern to the future of our people. And we have to have a trade-off.

Thank you, Mr. Chairman.

Mr. DOWNING. Mr. Ginn?

Mr. GINN. Thank you, Mr. Chairman.

I regret very much I had to miss most of the testimony because of the conflicting of the meeting I had this morning.

On page 5 of the report, the statement is made that:

In the face of an adverse trade balance, the near \$1 billion annual payment deficit due to fish imports merit greater attention.

The rapidly rising price of oil and gas hurts the pocketbooks of consumers directly."

I will not ask for any long elaboration, but can someone give me an explanation of that?

Dr. NIERENBERG. The figures will be made more precise by Mr. Fulham, but as I remember we have a consumption of about \$5 billion a year for fisheries products in this country. We import \$1.5 billion and export about a quarter of a billion. This represents a net trade deficit of more than \$1 billion in the fisheries.

In other words, we spend a difference of \$1 billion a year to make up our requirement in fisheries products.

Mr. FULHAM. We can bring it into clearer focus by realizing that 66

out of 100 pounds of seafood consumed in the United States is imported, and this has gone in period of 25 years from 25 pounds.

Mr. GINN. I did not realize the percentage was that high.

I really would like to pursue that, but Mr. Breaux probably has some questions.

Thank you, Mr. Chairman.

Mr. DOWNING. Mr. Breaux?

Mr. BREAUX. Thank you, Mr. Chairman.

Thank you, gentlemen, for appearing. I think you have covered a wide range of subjects dealing with our present problems, all of which, I think, are very important for the Congress to be brought up to date on. And I thank you for coming and doing so.

Dr. Clewell, you have touched on an area of great interest to me when you talk about offshore ports. The subject also is of interest to other members of this committee, along with members of the Public Works Committee, where a bill on offshore ports is pending.

One of the questions and one of the points made in your statement, I think, and also in the advisory commission's report, is that apparently all of you have given some attention to the question of whether deep water ports should be single-purpose ports only for importation of oil products or whether they should be multipurpose ports. Apparently you have come to the conclusion that preference at this time is a single-purpose port.

Dr. CLEWELL. Well, the thought there is this, that, in the first place, regarding imports, well over half is petroleum. So, then, at least you have a reason for thinking about a special purpose port for that one product.

Mr. BREAUX. You say that more than half of all our products imported are petroleum?

Dr. CLEWELL. That is by weight.

I may take that figure back.

Let me say this, and I know this for sure, that of everything moving in New York Harbor, 60 percent of it is petroleum on a tonnage basis.

Whether or not this is true of our other imports, I will take that back.

Anyway, our imports are a very, very significant factor.

Now, the other thing, of course, oil is a significant part of all of our imports. And I think, even traveling on the high seas, and you will find more tankers than any other kind of ship.

The thing about the special purpose port, the single point mooring, they can be put in quickly and the investments are relatively low, and they can be located quite some distance offshore. And we can have pipelines to move the oil to the shore.

I think the reason there is simply because of the large volume of petroleum imports and the fact that the single point moorings are amenable to quick installation.

Mr. BREAUX. One final quick question, Mr. Chairman.

Have you come to a conclusion, as to whether it be preferable that these type ports be privately owned or federally owned?

Dr. CLEWELL. Well, I think that the private industry, of course, has a real interest in this, and as far as a specific purpose, I think it would be better if you leave this kind of funding up to the private interests rather than have the taxpayers do it.

Mr. BREAUX. Thank you, Mr. Chairman.

Mr. DOWNING. Counsel?

Mr. HEYWARD. Thank you, Mr. Chairman.

I would like to go back to Dr. Brooks' statement, if I may. In connection with reference two, if I understand what you are saying, there is a lack of adequate focus in the overall uses and resources of the ocean and the ocean itself is a resource.

And you see a need to focus the problem, as far as management is concerned, better in the executive department.

Now, as you are aware, there is consideration in the Congress now on the reorganization of the committee jurisdictions, and I do not want to go into that at this point.

I would like to ask you if we are to develop what we can truly call a national ocean program, what is the first step?

Is it to create an independent agency?

Is it to create a separate department which focuses on ocean programs?

Is it an attempt on the part of this committee or the Congress to, in some way, establish a national policy through legislation?

What is the first step that should be taken?

Dr. BROOKS. Your question has a little bit of the flavor of the old story about asking a centipede which leg he steps out with first causing him to stumble with the other 99.

There are, of course, a number of steps that should be taken in coordination with each other.

Mr. ROGERS has emphasized the one, adequate funding for the programs that now exist. That obviously is a current and continuing concern, and will remain so for some time to come.

To address the question of focus in management it seems to me that although it is important that the Congress structure its committee responsibilities to harmonize with the activity the executive branch is responsible for carrying out, that it is the activity in the executive branch which has the most direct relationship to the productivity of the programs which it is responsible for.

In other words, the manager of the Nation's programs in this area, as in others, is the executive branch, and the Congress provides the means and the guidelines by which management is carried out.

I would suggest that it is the executive branch organization which is really essential and should be a first order priority in the movement toward a more focused national program.

Dr. NIERENBERG. Could I respond to your question in a slightly different way, being very specific first and very general secondly?

Specifically, I think it is fair to say, as briefly as I can, that the Committee is prepared to recommend strongly and urge Congress the formation of an independent agency for carrying out the central focus that we have described here if the other legislative actions do not take place, for example, the DENR. And I think I speak fairly for the committee in this regard.

The general question, though, if I may at this late hour, Mr. Chairman, as I told you and other Members of the Congress in the past several years that we were prepared, as a matter of priority, to neglect our relationships with the Congress in favor of cultivating the administration, if you want to call cultivating pushing, shoving and hauling,

and so on, because the good state we find ourselves in this country in oceanic affairs has been due to the unremitting efforts of Congress over these years and particularly this committee.

This committee's actions have certainly been responsible almost directly for the relatively fine shape we find ourselves in. But this other question, namely the central focus in the administrative apparatus, seems to be the remaining difficult question.

You know, as one says, eternal vigilance is the price of liberty. We have perhaps not paid as much attention to some of the developments in the Congress as we should. It may turn out that we may have success in developments on the administrative front in finding a central focus, but shall have lost, to some degree, in the reorganization of Congress that is pending.

I suppose some of the legs of the centipede, Mr. Brooks, was just talking about, would be lost.

Mr. HEYWARD. I did not want to in any way imply that your committee has not done an excellent job. You have done an excellent job.

I wonder whether or not you would be in accord with the idea that NACOA should function as a central point, for being the catalyst, so to speak, in creating more awareness for the need of an ocean program, that is a uniform approach to ocean uses?

I think that your report indicates that, but for the record I would like to get the answer.

Dr. NIERENBERG. The answer is yes.

Mr. HEYWARD. Let me ask one other question.

If you are looking for, or recommending an independent agency, I am sure you realize that an independent agency is not going to be the only agency in Government that has any interest in the oceans. That is impossible.

Is there a need for a stronger interagency mechanism under the leadership of this independent agency which could serve to focalize the function?

Dr. NIERENBERG. The answer would be yes.

I suppose our report really did make this point. It really did. It is in the report because, as an example, we recognize the very great importance of supporting and continuing the work of the Office of Naval Research on the one hand, and the National Science Foundation and its role in basic science on the other, even with the development of the central focus and the central agency we are talking about, as well as other agency interests.

I pick those two in particular so the answer is distinctively yes, we do and, in effect, we do refer to that in our report.

Mr. HEYWARD. In the next few weeks, as soon as we can schedule them, we will be considering various ocean activities as reflected in the Federal ocean program report.

I recognize the comment Dr. Brooks made, that that report seems to have, in essence, or in part, fallen between the cracks.

Has NACOA looked at this type of activity as to whether or not NOAA should have the responsibility now or in the future in preparing that type of report?

Dr. Brooks. The answer to that question is not in our report, but I do recollect NACOA discussion of the need for an annual report covering the entire spectrum of ocean programs from the leading ocean figure in DENR, supposing that DENR does have a leading oceanic official of the scope that we just described in our testimony today.

That function is one that could be quite logically assigned to a lead agency, which is essentially the mechanism you are talking about. And although it does not appear explicitly in our report or our testimony, the discussion of the issue in committee meetings did bring that suggestion out.

Dr. NIERENBERG. Mr. Chairman, very specifically, one does so many things. We have gone into that in considerable detail. It does not appear in our report.

Mr. Chairman, it does, however, appear in the back of a document which goes in greater detail than this report as to the grouping of oceanic affairs in the central place in the administration, specifically in the DENR, but it could be placed somewhere else.

I am referring to the backup document we prepared for the administration and for the Congress on S. 2135 and H.R. 9090. It has gone forward to Senator Ribicoff. Since it does touch on many of the questions you are talking about, it probably would be very valuable to present it for the record of this hearing.

Mr. Chairman, this goes into detail on just exactly that question. It was too detailed for the report.

Mr. DOWNING. Well, without objection, that report or parts of it will be made a part of the record at this point after perusal by counsel.

I think it would be very fair to have that information.

[The information to be supplied follows:]

U.S. SENATE.
COMMITTEE ON GOVERNMENT OPERATIONS,
SUBCOMMITTEE ON REORGANIZATION, RESEARCH, AND
INTERNATIONAL ORGANIZATIONS,
Washington, D.C., March 6, 1974.

Chairman WILLIAM A. NIERENBERG.

National Advisory Committee on Oceans and Atmospheric Main Commerce Building Washington, D.C.

DEAR MR. NIERENBERG: The Subcommittee on Reorganization, Research and International Organizations, which I chair, is presently considering legislation to create a Department of Energy and Natural Resources (S. 2135) and legislation to create a separate Energy Research and Development Administration (S. 2135, S. 2744).

S. 2135 would transfer NOAA from the Commerce Department to the new DENR. In view of the familiarity of the National Advisory Committee on Oceans and Atmosphere with the government's whole oceanic and atmospheric program, the Subcommittee would welcome any written comments your committee wishes to submit on S. 2135, particularly with reference to NOAA. Since the type of problems ERDA is likely to face may be similar to some of the problems NOAA has experienced, we would also be interested in any comments you had on how ERDA should be organized, and whether it should be independent, or part of another energy agency.

Any statement you provide us on this legislation will, of course, be included in the records of these hearings.

Sincerely yours,

ARF RIBICOFF.

NATIONAL ADVISORY COMMITTEE
ON OCEANS AND ATMOSPHERE,
Washington, D.C., March 6, 1974.

HON. ABRAHAM RIBICOFF,
Chairman, Subcommittee on Reorganization, Research and International Organizations, Committee on Government Operations, U.S. Senate, Washington, D.C.

DEAR SENATOR RIBICOFF: On behalf of the National Advisory Committee on Oceans and Atmosphere (NACOA), I welcome your invitation of 6 March 1974 to comment on legislation under consideration to create a Department of Energy and Natural Resources (S. 2135) and to create a separate Energy Research and Development Administration (S. 2135 and S. 2744).

As you know, the Congress established NACOA by P.L. 92-125 to report to the President and to the Congress its overall assessment of the Nation's marine and atmospheric activities. We, therefore, direct our comments primarily to aspects of the legislation that impact on the Nation's prospects as a maritime power in the coming age of intensifying competition over the uses of the sea and its resources, and on closely related atmospheric matters such as weather prediction and modification and climate change.

We addressed these issues and their organizational implications in considerable detail in our Second Annual Report to the President and the Congress, dated 29 June 1973. For your convenience, however, we have prepared the accompanying material derived from the Report but adapted to the legislative matter in hand, S. 2135. It includes a comprehensive statement of our position concerning organizational issues, and attachment developing our suggestions for a national marine affairs policy statement, a detailed listing of the major marine functions that we feel a DENR should perform, and finally specific amendment to S. 2135, with supporting discussion, to which we invite your attention. I trust you will find this helpful.

The Committee has taken no position specifically on the legislative proposals for ERDA. At the same time, since offshore oil plays such an important part in the National future, we have, of course, considered it in connection with our assessment of all the uses of the sea. Certainly the concept of an entity charged with Federal leadership for the function of fundamental research and engineering development in this field is sound. At the same time, I believe that ERDA's prospective impact on marine and atmospheric affairs is relatively independent of its location in the Federal structure, provided two somewhat competitive principles are maintained. These are that it should be aware of and responsive to national energy policy, a responsibility proposed for DENR, but sufficiently free from pressures to meet "fire alarms" that its unique responsibility for anticipating medium and long-term needs is not jeopardized.

I shall be very glad to respond to further questions on these matters should you care to call on me.

Sincerely yours,

WILLIAM A. NIENBERG,
Chairman.

NATIONAL ADVISORY COMMITTEE
ON OCEANS AND ATMOSPHERE,
Washington, D.C., March 15, 1974.

STATEMENT ON A DEPARTMENT OF ENERGY AND NATURAL RESOURCES (S. 2135)

NACOA concurs with advocates of a greater centralization and more effective leadership of the Federal activities in natural resource management. NACOA supports the concept of a Department of Energy and Natural Resources along the general lines developed in S. 2135, and its House counterpart, H.R. 9090. In particular, NACOA believes that to obtain the best use of our oceanic, coastal, and environmental resources, responsibility for their management should be given a central focus, and included among the natural resource management responsibilities of such a Department.

However, we note in S. 2135 and H.R. 9090, a preoccupation with problems of terrestrial resources development and an inadequate assessment of both the opportunities and problems of developing marine and coastal resources.

These problems involve special relationships between resources and the environment quite different in important respects from those on land. They produce

correspondingly special operating situations and special technological requirements as well as vastly more ambiguous and uncertain issues of ownership, jurisdiction, and law. Further, the evidence of the special and vital importance of the seas to the United States, economically, politically, and socially, long recited by a few is now beginning to be recognized by the many. This is in part because the tightening of supplies of energy, food, and minerals and the threat of marine pollution, now clearly affecting us have revealed the growing hazards of international anarchy at sea as all the maritime and many landlocked nations of the world intensify their attempts to command a wider share of its resources.

Although, we agree that, at the highest policy and planning levels, the role of marine resources must be developed in a national resources context involving all natural resources regardless of origin, we believe that at the policy implementation level the Department's organization should show a special marine focus by the way its oceanic, coastal, atmospheric, and geological activities are grouped. In NACOA's opinion, it does not now do so.

NACOA is prepared to work with the Administration and with the Congress to bring about a bill more suited to the national need for effective marine and coastal resource management and for the appropriate environmental science and services.

We are pleased to note the recent Senate initiative in the adoption of Senate Resolution 222. The extensive support for this resolution demonstrates the Senate's concern. Our objectives are the same as those expressed in the resolution and in the statements of the cosponsors and we believe that a well structured Department of Energy and Natural Resources could be an effective instrument for carrying out many of these objectives.

NACOA sees four major deficiencies in the marine affairs and environmental services portions of the present bill. These are the lack of a suitable marine affairs policy statement, an inadequate statement of the associated functions needed to implement this policy, a failure to specify which functions should be the responsibility of the various Administrators, and the omission of certain transfers to the Department that would, in NACOA's opinion, strengthen the national effort if included.

NACOA believes that a marine affairs policy statement is needed to draw attention to the uniqueness of the problems of marine resources management and to give a fresh impetus to the national marine policy stated in the Marine Resources and Engineering Development Act of 1966 (P.L. 89-454) which has not been rescinded even though never fully implemented. Such a statement is attached. (Attachment #1) It subsumes and could be considered to replace the 1966 statement.

Although a long list of functions required to implement this national policy could be drawn up, the gist can be conveyed by three summary statements. These are:

Encouraging the development and conservation of marine resources including offshore oil and gas, other minerals, and fish, and the promotion of other uses of the coastal and marine environment including recreation, waste disposal, siting of facilities, and transportation to meet national needs;

Coordinating and regulating these activities in the light of their environmental impact, national economic objectives, multiple-use conflicts, and international implications;

Providing technical, engineering development, and scientific services that cut across organizational lines, within and outside the Department, including surveys, environmental monitoring, prediction and control, and basic information relating to engineering and technology development.

A more detailed list is attached. (Attachment #2) It includes the present functions of NOAA and the Geological Survey, the marine and coastal zone portion of the Corps of Engineers' civil planning, policy, and funding activities, the mineral leasing program on the Outer Continental Shelf presently assigned to the Department of Interior's Bureau of Land Use Management, and the U.S. Coast Guard. We recommend that all these functions with the exception of those of the Coast Guard be assigned to the Administrator of the Oceanic, Atmospheric, and Earth Sciences Administration (OAESA) within the DENR but that the name of the Administration be changed to reflect the fact that its functions go beyond those of providing scientific information and technical services. There are many possible alternatives. For the moment NACOA suggests "the Marine Resources and Environmental Science and Services Administration

(MARESSA)." This not only seems to describe the scope but recalls the historical fact that ESSA, the Environmental Science and Services Administration and the direct predecessor of NOAA, is incorporated with the new Administration.

ATTACHMENT No. 1

SUGGESTED NATIONAL MARINE POLICY STATEMENT

The Congress further declares that the Federal Government has a national responsibility to develop and manage a coordinated, comprehensive and long-range national program in marine and coastal zone affairs and in environmental science and services for the benefit of this nation and of mankind, for the protection of health, property, and the environment, for the balanced utilization, conservation and management of marine resources and for the enhancement of our commerce, transportation, and national security.

ATTACHMENT No. 2

SUGGESTED MARINE RESOURCES AND ENVIRONMENTAL SCIENCE AND SERVICES FUNCTIONS FOR DENR

promote environmental protection.

1. At the most general level there are three:

(1) Marine Resource Development and Conservation:

This function includes responsibility for establishing resource production and usage goals in recognition of supply and demand projections, determining the appropriate means required to achieve them, and bringing these means to bear in light of policy constraints regarding national priorities and laws passed to

(2) Marine and Coastal Zone Affairs Coordination, Regulation and Enforcement:

This function includes responsibility for determining the economic and social consequences of proposed development activity, determining the probable impacts on other developmental efforts and the environment, determining the tradeoffs of alternative development plans or policies, regulating development execution in accordance with law and established policies, and planning, funding and arranging for the conduct of marine related public works of national importance.

(3) Environmental Science, Engineering and Technical Support Services:

This function includes responsibility for carrying out scientific, engineering, and support services activities necessary to assure the timely availability of the scientific, technological and environmental knowledge needed to support decisions on proposed development activity, and the support and dissemination of appropriate technical information and scientific services where the benefits accrue to the public at large.

In addition we recommend that the Administrator of MARESSA prepare annually a five-year government-wide plan and budget program to advance oceanic, atmospheric, geological, and coastal zone science and services and marine and coastal resources management. This plan and budget program should be transmitted to the President through the Secretary of DENR. The Administrator of MARESSA should also be responsible for coordinating the civil oceanic and coastal zone affairs and the oceanic, atmospheric, geological and other environmental science and service activities of the Federal Government and should provide program and funding guidance to all agencies engaged in such programs.

The U.S. Coast Guard, the agency responsible for marine law enforcement as well as for marine safety, for the provision of navigational aids, and for marine search and rescue, belongs we feel at a high level within the DENR and independent of the Administrator of MARESSA. The basic reason for this recommendation is to place the agency in closer organizational proximity to the activities with which it has a primary need for exchanging information but to avoid placing it in a position where its accountability for law enforcement might be obscured by the Administration of MARESSA's accountability for the relevance and adequacy of the regulatory ordinances and restrictions themselves.

By somewhat similar reasoning, we recommend that MARESSA assign the responsibility for its functions to three major but distinct activities, reflecting the three-fold division already identified on page 3 above. These are, to recapitulate, (1) marine resource development and conservation, (2) marine and coastal zone

multiple use coordination and regulation, and (3) environmental science, engineering, and technical support services. Attachment #3, "Suggested Amendments to S. 2135," summarizes the recommendations that we have discussed above.

Finally, we might say a word about NACOA itself. We feel that however successful the DENR, there will remain a need for a continuing oversight and advisory activity to apprise both branches of government on the Federal success in marine affairs and environmental services. This is not only because many related Federal activities will obviously remain outside the DENR—the Navy, MARAD, EPA, and NSF for example—but more important because state and local governments, industry, our universities, and the general public all have an interest, whether recognized or not, and a role to play in mobilizing and imparting energy to the undertaking needed to realize the full scope of this nation's interests in the sea. NACOA's statutory scope and non-Federal composition appointed from all the above constituencies provides top levels of government and in prospect—the Secretary of the DENR with an unique source of balanced and comprehensive advice. To effect the requisite change in the event of the formation of a DENR, NACOA's enabling statute, P.L. 92-125, need merely be rewritten to substitute the phrase, the Secretary of the DENR, wherever reference is made to the Secretary of Commerce, and to substitute MARESSA when the Act refers to NOAA.

II. At the next level of detail each of these broad functions should be further subdivided as follows:

(1) Marine Resource Development and Conservation:

(a) The assessment and management of marine fisheries resources and marine mammals.

(b) The provision of assistance to the commercial fishing industry.

(c) The stimulation and support of sport fishing and marine recreation.

(d) The assessment and management of marine non-living resources.

(e) The provision of assistance to commercial energy and mineral industries operating in the marine environment.

(2) Marine and Coastal Zone Affairs Coordination, Regulation and Enforcement:

(a) The protection and multiple-use management of the coastal zone and its resources.

(b) The supervision of exploration and development under mineral leases and permits on Federal lands.

(c) The enforcement of Federal marine laws and regulations and promotion of marine safety.

(d) The minimizing and assisting in the resolution of use conflicts in the marine environment by providing advice and counsel to Federal and State agencies on questions of multiple use.

(e) The development of an overall plan for the use of marine areas within and beyond the territorial sea.

(f) The coordination of permit and regulatory activities in the marine area.

(g) The planning, evaluating, and budgeting of the Civil Works function of the Corps of Engineers within the marine area.

(h) The management of leasing programs for oil and gas, and other minerals on the U.S. outer continental shelf.

(3) Environmental Science, Engineering and Technical Support Services:

(a) The conduct of surveys, assessments, and investigations of the physical, chemical, and biological characteristics of the oceans and the lakes.

(b) The conduct of surveys, assessments, and investigations of the geological and geophysical processes of the solid earth and its resources.

(c) The provision of the Nation's weather monitoring and prediction services.

(d) The conduct of weather modification research.

(e) The monitoring of streamflow and water quality, the determination of the distribution and character of subsurface water, and the assessment of the Nation's water supply.

(f) The operation of environmental and earth resources satellite monitoring systems, and the application of data therefrom.

(g) The provision of warnings and development of knowledge of natural hazard (tornadoes, hurricanes, severe storms, earthquakes, tsunamis, volcanic eruptions and landslides) for the preservation of life and protection of property.

(h) The production of maps and charts for the earth, the oceans and the national air space.

- (i) The establishment of geodetic data.
- (j) The provision of comprehensive environmental and other data services.
- (k) The classification of public lands for leasable minerals and water power sites.
- (l) The identification and evaluation of potential energy and mineral resources, including those of the outer continental shelf.
- (m) The conduct of research and technological development consistent with agency responsibilities.

ATTACHMENT No. 3

SUGGESTED AMENDMENTS TO S. 2135

1. *Section 101.* On page 2, after line 24, insert a new subsection (3) as follows: "The Congress further declares that the Federal Government has a national responsibility to develop and manage a coordinated, comprehensive and long-range national program in marine and coastal zone affairs and in environmental science and services for the benefit of this nation and of mankind, for the protection health, property, and the environment, for the balanced utilization, conservation, and management of marine resources, and for the enhancement of our commerce, transportation, and national security."

Explanation

S. 2135 as it now stands reveals a preoccupation with problems of terrestrial resources development and an inadequate assessment of both the opportunities and problems of developing marine and coastal zone resources and associated science and services. This statement draws attention to the fact that marine affairs management offers problems in the relationship between resources and the environment that make it unwise to treat activities offshore or in the coastal zone as mere extensions of what goes on inland. In addition, marine activities involve complicated issues of ownership, jurisdiction, and law. Finally, this statement in effect subsumes the policy statement of the Marine Resources and Engineering Development Act of 1966 (P.L. 89-454) and gives it fresh impetus in a somewhat larger context.

2. *Section 101.* On page 4, line 4, after the word "minerals" and before the word "preserve" insert the following phrase "coordinate and regulate the multiple uses of marine areas under U.S. jurisdiction and the marine activities of U.S. nationals elsewhere to assure balance and compatibility among uses to meet U.S. needs and treaty obligations and with due regard for the sea and its resources as a common heritage of mankind."

Explanation

This develops briefly in functional terms the marine analog to land-use management, and indicates its general nature and broad objectives. The danger of overlooking this function and of failing to provide appropriate organizational means for its execution represents the greatest deficiency in the bill as it now stands from the marine affairs viewpoint.

3. *Section 202.* On page 5, lines 23-25, change "an Oceanic, Atmospheric, and Earth Sciences Administration, at the head of which shall be an Administrator of Oceanic, Atmospheric, and Earth Sciences" to read: "a Marine Resources and Environmental Science and Services Administration, at the head, etc."

Explanation

As indicated earlier, the functions which ought to be associated with the marine and environmentally oriented Administration within the DENR go beyond the conduct of R&D and technical services. The present designation for this Administration fails to convey this. In fact, it implies the contrary. Our proposed change in name, or something like it, brings out the highly important marine affairs management function.

4. *Section 202.* On page 6, line 1, after the present "Earth Sciences" and before "and an Inlan, etc.," insert "an agency for marine law enforcement, safety, navigational aids, and search and rescue, the U.S. Coast Guard, at the head of which shall be a Commandant."

Explanation

The U.S. Coast Guard, now in the Department of Transportation, and formerly in the Department of the Treasury, operates exclusively within the marine environment and performs functions associated with operations most of which

themselves are exclusively marine. In all respects its needs and capabilities for operational and technical information exchange, coordination, and support will be closer to those planned for the DENR than to its present assigned location. At the same time its primary function of marine law enforcement suggests that it report directly to the Secretary rather than through the Administrator of MARESSA, to avoid the conflict of interest between accountability for marine affairs regulation (MARESSA) and accountability for the enforcement of that regulation (USCG).

5. *Section 202.* On page 6, line 24, add to the paragraph as follows: "However the functions of the Administrator for MARESSA shall include beside those presently carried out by NOAA and the Geological Survey, the marine and coastal zone portion of the Corps of Engineers civil planning, policy, and funding activities, the mineral leasing programs on the outer continental shelf, and the preparation annually of a 5-year government-wide plan and budget program to advance oceanic, atmospheric, geological, and coastal zone R&D and marine and coastal resources management. The plan and budget program shall be transmitted to the President through the Secretary of DENR. In addition the Administrator of MARESSA shall be responsible for coordinating the civil oceanic and coastal zone affairs and oceanographic, atmospheric, and geological science and services activities of the Federal Government and shall provide program and funding guidance to all agencies engaged in such programs.

Explanation

The present section 202 (f) describing the functions of the leading officials of DENR merely states that they shall be specified by the Secretary. It seems likely that Congress will require at least the major functions of the Administrators to be specified in the Act. We propose the above as a minimal statement for the functions of MARESSA. The functions of the Commandant, U.S. Coast Guard, should remain unchanged.

6. *Section 301.* On page 7, line 19, add "and the National Advisory Committee on Oceans and Atmosphere."

Explanation

Upon the formation of the DENR incorporating NOAA (under whatever name) the Secretary DENR will have responsibilities that put him in precisely the position vis-a-vis marine and atmospheric activities now occupied by the Secretary of Commerce. The responsibilities of the Secretary of Commerce regarding NACOA should therefore also be assumed by the Secretary of DENR and NACOA responsibilities to the Secretary of Commerce be redirected to apply to the Secretary, DENR. NACOA's enabling statute, P.L. 92-125, of course would require similar amendment to correspond.

7. *Section 301.* On page 9, line 21, after "pipeline safety" add "and the U.S. Coast Guard."

Explanation

This follows from No. 4 above.

8. *Title III and IV.* There are a number of amendments of an editorial nature required in Titles III and IV to make them consistent with the above. For example, on page 15, line 22, after the word "abolish," the words "U.S. Coast Guard" should be inserted. We will not specify them here.

Dr. HARGIS. Mr. Chairman, in response to counsel's question, too, I think, when NACOA had its first series of meetings, we did look into the question of what functions the Congress intended for us to have, and what we were going to be able to do.

And one of the questions was, are we the successor to the Council which was in the Vice President's office for a time, and which Dr. Wenk headed, and who incidentally was on the committee the first year? And I think we decided it was not possible for us to do the same kind of thing, that that was something that perhaps ICMSE was now constructed to do.

I would, however, venture to say on my own that I think there does need to be someone to take up that part of the evaluation that the old Council did, the state of the oceanography operation within the Federal executive.

The recent reorganizations of the executive operation has downgraded the Council on Science and Technology, and other things, and I do not see any organization taking their place at the same level at the present time.

There is a report on the Federal ocean program being issued, but it is not, in my opinion, the same quality as it used to be.

Mr. HEYWARD. Well, as I understand it, NSF has fallen heir to the responsibilities for preparing that report because OST was disbanded.

Is it your impression that the chairmanship of the interagency committee alternates, or is the head of the NOAA the permanent chairman?

Dr. HARGIS. It is the head of NOAA.

Mr. HEYWARD. In connection with your comments on the Council, maybe I am wrong, I would view your position more toward a continuing Stratton Commission than I would as a marine science council.

I think the interagency mechanism should handle that.

Dr. HARGIS. I agree.

Mr. HEYWARD. And, of course, the Stratton Commission was set up for a different purpose. But I think you furnish the follow-on, the expertise in the public community, to tell Government what it is or is not doing properly in the field of oceanic and atmospheric affairs.

May I briefly go to the question that you raised in connection with coastal zone management?

I have forgotten exactly the form in which you expressed it, but I wonder whether or not there is any need for legislation, in addition to the Coastal Zone Management Act, which was designed to encourage the States via the coastal zone management program, for some complementary Federal legislation, policy, whatever you may call it, outside the coastal zone line, that is, the 3-mile limit. And particularly I think this may be important if we are going to have any results from the Law of the Sea Conference where there will be initiatives for economic resource zones.

Dr. HARGIS. There may very well be.

When, as you well likely recall, Mr. Counsel, when we were working on the details of the legislation, I think we did not have in mind the type of construction that has recently developed in the definition of the coastal zone.

Some of us had in mind a broader definition which would have taken us out beyond the 3-mile territorial limit—ignoring the fact that the States, Maine down to Georgia, are involved in a suit for greater territorial jurisdiction.

Mr. HEYWARD. You mean we should regulate the Virginian sea?

Dr. HARGIS. That is correct.

We did have, at that time, some idea that the Coastal Zone Management Act would encompass that, but it does not. I think that question needs to be considered very carefully in the next phase. There is a gap.

Mr. DOWNING. If minority counsel has some specific questions, they will be directed to Dr. Nierenberg in writing, and he may respond.

Dr. Nierenberg, we are going to hold hearings in depth on these matters, and it was felt that perhaps if you and your committee could arrange it to come back at the end of the hearings and give us your ideas, or give us a summary and your recommendations as to what we should do, I think it would be most helpful.

Dr. NIERENBERG. We will be absolutely delighted to do that.

Our staff, of course, will follow your hearings very closely. And we will have at least one opportunity to discuss progress in a full meeting of NACOA. And we will do just that.

Mr. DOWNING. Again, I want to thank each one of you gentlemen for the very fine presentations that you have made here today.

I think I can tell you that it is the consensus of this committee that NACOA has done a fine job and is doing the job that Congress intended it to do.

Again, each of you should be complimented, and you certainly have the thanks of the committee.

The committee will stand in recess until Friday at 10 a.m.

[Whereupon, at 12:30 p.m., the subcommittee recessed, to reconvene at 10 a.m., Friday, March 29, 1974.]

FEDERAL OCEAN PROGRAMS REVIEW

FRIDAY, MARCH 29, 1974

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee reconvened, pursuant to recess, at 10:10 a.m., in room 1334, Longworth Office Building, Hon. Thomas N. Downing, chairman, presiding.

Mr. DOWNING. The subcommittee will come to order.

This morning, we will continue our hearings on the review of Federal ocean programs.

This morning we have with us the National Oceanic and Atmospheric Administration, headed by Robert M. White, Administrator, accompanied by Mr. David H. Wallace, Associate Administrator for Marine Resources, NOAA; Dr. Robert B. Abel, Director, national sea grant program, NOAA; Dr. Edward S. Epstein, Associate Administrator for Environmental Monitoring and Prediction, NOAA; and Mr. Robert W. Knecht, Director, Office of Coastal Environment, NOAA.

Will you gentlemen take your places at the witness stand, please?

The committee also notes the presence of Mr. Howard Pollock.

I have a short opening statement. If there is no objection, I will just submit it for the record at this point.

[The statement follows:]

STATEMENT BY THOMAS N. DOWNING, CHAIRMAN, SUBCOMMITTEE ON OCEANOGRAPHY

The subcommittee is meeting today to continue the hearings related to the various aspects of Federal ocean activities. In the first of these hearings on March 26, the subcommittee received a report from the National Advisory Committee on Oceans and Atmosphere, relative to its responsibilities under Public Law 92-125. Today, we will proceed to hear from the agency established by Reorganization Plan No. 4, of 1970, designed to serve as the focus of Federal Oceanic and Atmospheric initiatives. Since being created in 1970, the National Oceanic and Atmospheric Administration has, in my opinion, made significant progress toward what I hope we can, in the future, call a true National Ocean Program.

We are, therefore, pleased this morning to hear from Dr. Robert M. White, the administrator of the National Oceanic and Atmospheric Administration, who is accompanied by several senior members of his staff. I trust that he and the other witnesses will give us a clear insight into the progress made during the last year, as well as an understanding of the problem areas which exist and of their plans to resolve them.

Dr. White, if you will now come forward, the subcommittee will be happy to hear from you and your associates, and you may proceed in whatever manner you see fit.

Mr. DOWNING. All right, Dr. White, you may proceed.

STATEMENT OF DR. ROBERT M. WHITE, ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE; ACCOMPANIED BY HOWARD POLLOCK, DEPUTY ADMINISTRATOR; DR. JOHN W. TOWNSEND, ASSOCIATE ADMINISTRATOR; AND WILLIAM BREWER, GENERAL COUNSEL

Dr. WHITE. Mr. Chairman, I have accompanying me here at the table, prior to the other witnesses appearing, our Deputy Administrator, Howard Pollock, who, of course, is well known to you; our Associate Administrator, John W. Townsend; and Mr. William Brewer, our General Counsel, who will join with me in this part of the testimony.

NOAA, Mr. Chairman, and members of the committee, is 31½ years old. The first and basic goal of the President and the Congress in establishing our agency was to create within the Federal Government a central focus for a large number of previously diffused ocean activities. Largely because of the stimulation and interest of the Merchant Marine and Fisheries Committee, we believe that during this exciting period we have achieved many of the goals set for us.

The wisdom of assembling responsibility for multifaceted aspects of the Nation's ocean interests in one organization has been borne out. This has enabled the management of interlocking programs in a way that makes each function an element of a larger national drive.

The sea grant college program, the coastal zone management program, and our various fisheries efforts are so intertwined that to deal with them separately, as would have been required prior to the creation of NOAA, would make administration difficult and consistent policy direction impossible. The weather features that control our lives are closely dependent upon the conditions of the sea. The technology of ocean observation is similar to that for the atmosphere. The underlying science of the dynamics of oceans and the dynamics of the atmosphere is common. But, most importantly, the protection of our citizens, their property and their environment require a unified consideration of the total environmental impact which would be difficult to achieve with a more dispersed set of organizations.

Another way of judging this is to look at the figures—the Commerce Department's ocean effort now closely approaches that of the Defense Department, the traditional leader. Commerce, through NOAA and the Maritime Administration, will account for 35 percent of the total Federal ocean expenditures representing \$216.3 million in fiscal year 1975. Contrast this with the situation 5 years ago when the Commerce Department accounted for \$54.8 million and 17 percent of the total Federal ocean budget. NOAA alone accounts for \$188 million.

To place this in perspective, we might point out that NOAA's ocean tasks occurred against a background of generally growing Federal ocean expenditures. For fiscal year 1975, the President has proposed a total of \$738 million for the Federal ocean program—an increase of nearly \$100 million over the fiscal year 1974 request. In particular, NOAA's ocean program is proposed for an increase of \$22 million over fiscal year 1974.

Dollars tell part of the story, but they are not the only measure—and sometimes not the most pertinent measure—of what is happening. The emergence of a central Federal agency to deal with the wide range of ocean efforts has given other governmental entities a place to go for assistance and a focal point for the Congress as it establishes new ocean policies and laws.

NOAA has given the Nation a mechanism to assist in addressing in an integrated way the urgent problems of ocean food supply management, environmental degradation, the development of ocean energy resources, and the ever-present challenge of protecting our people and their property from ocean-related natural hazards.

NOAA, as the subcommittee knows very well, has been constantly changing and evolving. The President and the Congress have refined NOAA's charter almost continually through a variety of legislative enactments: the Marine Mammal Protection Act, the Marine Protection, Research, and Sanctuaries Act, the Coastal Zone Management Act, the Endangered Species Act, the Offshore Shrimp Fisheries Act, and the Weather Modification Reporting Act, come most immediately to mind.

I need not tell this subcommittee of the pioneering nature and the complexity of some of these new statutory responsibilities. Let me say that they are formidable, and that we welcome them.

We intend that NOAA be responsive to the Congress, the public, and to the advisory bodies created by statute. In the latter case, we look to NACOA, the National Advisory Committee on Oceans and Atmosphere, as the senior advisory body. NACOA, an outstanding Presidentially appointed group, advises the Secretary of Commerce on the activities of NOAA, and reports to the President and Congress annually on the entire Federal oceanic and atmospheric effort. NACOA does not hesitate to criticize NOAA—that is one of its functions. Personally, I have found the criticism stimulating and the ideas valuable—and have been guided by many of NACOA's recommendations in the formulation and execution of our programs.

For example, NACOA recommended a comprehensive national fisheries plan. NOAA has established a planning group which is even now working on it.

NACOA expressed concern about the adequacy of capital facilities to support the Nation's ocean effort. The Center for Naval Analysis is undertaking a comprehensive study on behalf of all Federal agencies.

Now, let us turn inward. We have found that NOAA works best when organized into broad programs dealing with ocean resource development and conservation on the one hand, an environmental monitoring, prediction and control of the other. Each is under the direction of an associate administration—in the first case, Mr. David Wallace; in the second, Dr. Edward Epstein. You will hear from both of them today.

Their tasks are very different, but they share determination to bring to bear all of NOAA's diverse skills and resources toward the solution of problems in each area. It is amazing how many atmospheric talents and facilities bear upon the oceans, and vice versa.

Since we last appeared before this subcommittee about one and a half years ago, an Office of Coastal Environment has come into being, charged with making a reality of our coastal zone management pro-

gram. This office has been extremely effective, due in no small part to the work of Mr. Robert Knecht, its Director, from whom you will also hear later today.

Two weeks ago, at the National Conference on Coastal Zone Management in Charleston, S.C., Commerce Secretary Frederick B. Dent, announced award of the first planning grants under this program to the States of Rhode Island, Oregon, and Maine. We believe that before this fiscal year ends, the program will be in full swing, with grants to some 28 of our 34 Coastal States. The full \$12 million appropriated by the Congress will be effectively used except for carry-over funds for establishment of marine sanctuaries in the future. In the fiscal year 1975 budget now before the Congress, President Nixon has asked for an additional \$12 million for the coastal zone management effort. Next year, we expect to begin funding State plans which have been approved by the Secretary of Commerce.

NOAA has assumed new responsibilities under the Marine Protection, Research, and Sanctuaries Act for the conduct of research on ocean dumping. To do this, we have established a marine ecosystems analysis program—MESA, if you will. We have assembled a cross-section of many NOAA talents—for example, ship operating and scientific capabilities of the National Ocean Survey, the research resources of the National Marine Fisheries Service, and the Environmental Research Laboratories, and groups under the sea grant program. As time goes by, it is inevitable that other NOAA groups will be called upon; NOAA is, for all its size and diversity, close-knit by design. Project headquarters have been established at the State University of New York at Stony Brook, Long Island, for the first field operations in the New York Bight.

The importance of this effort is demonstrated by the recent publicity attendant upon measurements suggesting that there may be a migration of sewage sludge from ocean dumping sites in the direction of the excellent Long Island and New Jersey beaches. NOAA is sparing no effort to amass the information necessary to the accurate prediction of the consequences of offshore dumping to these waters. Intense as the local concern is, the immediate answer is not the only one. Information gained here will help solve a whole range of national problems which come into sharp focus along our coasts—the building of offshore facilities, the development of energy resources, ocean transportation, offshore nuclear powerplants—the list could be much longer.

Recognizing the importance of this work, and of New York Bight as a natural laboratory, President Nixon is seeking an increase of \$1.9 million for these studies and another \$300,000 to start planning studies on a similar project in the Puget Sound area, where the possible environmental impact of the Trans-Alaska Pipeline System is of compelling concern.

You are the subcommittee which created the national sea grant program. Your interest in this program has been amply demonstrated, to the betterment of the Nation. The last time we appeared here, we indicated that the applied research and education programs specified by the enabling legislation were developing rapidly, and that the time had come to strengthen the marine advisory services which were also required by law. The sea grant program has been designated the principal focus in NOAA for marshaling all of our resources to provide

these services. Such services have been established in 22 States with approximately 130 persons working directly with fishermen, marine operators and other shoreside industries.

You will also be pleased, I am sure, to know that we have designated one additional sea grant college, the University of California, for a total of seven. Dr. Robert Abel, the sea grant program director, will report to you later today, but let me point out for now that President Nixon has requested another \$4 million for this program in fiscal year 1975, boosting the total request to \$25 million.

Many of our new responsibilities are in fisheries or fisheries-related fields. The Marine Mammal Protection Act, the Endangered Species Act, and the Offshore Shrimp Fisheries Act all have been assigned to the National Marine Fisheries Service for management and implementation.

I am pleased to be able to report to you that our efforts to strengthen this vital agency have been successful. Since we last met, Mr. Robert Schoning of Oregon has been appointed as Director, and new faces and new philosophies have appeared.

Our major challenge has been in fisheries management. We are working with the States toward cooperative management of our fisheries resources.

Progress is good in setting up cooperative systems for management of lobster and shrimp in the Northeast, menhaden in the Gulf, and Dungeness crab in the Pacific.

But it is clear that rational and fair management of fisheries resources off our shores cannot be achieved without adequate international arrangements. The picture is less bright here. We see progress in some areas, but not nearly as much as we need. In the Northwest Atlantic we have made some headway toward international agreement to reduce total foreign fishing effort. Some small progress has been made in the Pacific.

The long-awaited Law of the Sea Conference session opens on June 20, in Caracas, Venezuela. Nothing on the horizon will so vitally affect this Nation's ocean policies and programs as the outcome of this international effort. At stake are our hopes for a general regime which will give us control of our coastal fisheries by international agreement rather than unilateral action. This is the key to wise management of our fishing resources. Howard Pollock is devoting almost all of his time to leading NOAA's and the Commerce Department's efforts in these negotiations.

Our newest resource responsibilities lie in the protection of marine mammals and endangered species. The general public shows greater concern for this cause than for any other in NOAA except the weather.

We have moved quickly to put both of these acts to work. Thus far, \$1.6 million has been appropriated for the Marine Mammal Protection Act, and the President is seeking an increase of approximately \$1 million in the 1975 budget now before the Congress.

Our battle to save the world's whales is a matter of tremendous personal concern. Last year, the President appointed me as the U.S. Commissioner to the International Whaling Commission. I wish I could report that we have achieved the international conservation measures so desperately needed to save many species. The fight is not won, but it

is not over. Our efforts will continue and, insofar as possible, be intensified, with the support of much of the world's public opinion.

One of the great issues we are facing under the law is the protection of porpoises in connection with tuna fishing. The act provides a 2-year period during which research has been underway to reduce the deaths of porpoises in tuna nets to as close to zero as possible.

There was general skepticism at the time of passage of the act that porpoise mortality could be significantly reduced through such research. It is, therefore, with some satisfaction that I report what appears to be a bona fide breakthrough in the technology of tuna fishing gear. I say "appears" because the results are preliminary.

However, new types of nets have been developed which we believe will cut porpoise mortality by 80 to 90 percent—a potential saving of more than 200,000 porpoises each year. These nets are undergoing rigorous testing. If the tests confirm our preliminary results, we shall have struck a historic blow for the protection of marine mammals.

Under the Endangered Species Act of 1973, we share responsibilities with the Bureau of Sport Fisheries and Wildlife of the Interior Department. We have programed \$300,000 from current funds to move this program ahead. We intend to work out agreement with this Bureau on many aspects of this act's administration. Already we have reached agreement on enforcement procedures, and we hope to issue jointly regulations pursuant to this strengthened law.

A traditional NOAA activity has been mapping and charting the oceans for navigational purposes. The National Ocean Survey has succeeded in automating the preparation of nautical charts, which had been largely hand-drawn for half a century. The first charts prepared by these new methods are already in print and the President's fiscal year 1975 budget includes the significant increase of \$1.5 million for this activity.

Since last we met, exciting developments have occurred in ocean monitoring and forecasting, and in other weather activities.

We have, at the present time, five environmental data buoys deployed along the coasts of the United States to provide information necessary to the forecasts of coastal storms and other oceanic conditions for maritime safety and offshore development. Further development is required to reduce operating costs to a point where their use in substantial numbers would be feasible.

The technology of ocean monitoring is being revolutionized by the earth-orbiting satellite. I am pleased with the recent announcement by the National Aeronautics and Space Administration that the President has approved a new start for SEASAT, a satellite devoted exclusively to the monitoring of the oceans. The decision to move ahead was based on work carried out in NOAA and other organizations which proved that space probes can provide fresh new information on ocean phenomena.

If we are successful—as I am convinced we shall be—in our development of ocean-sensing techniques from satellites, it may finally be possible to achieve a simultaneous global view not only of ocean temperatures, which we have already demonstrated, but of sea surface heights. This would let us calculate the intensity of ocean currents and place us in a position to make worldwide forecasts of ocean current features.

The possibility of observing pollution in the ocean from space, as well as detection of biological characteristics important for the location of fisheries, are being explored. Some of the most advanced work in this area has been done by the Spacecraft Oceanography Group of our National Environmental Satellite Center and our Atlantic Oceanographic and Meteorological Laboratories at Miami.

Such ocean monitoring systems will become increasingly important, not only for the protection of life and property, but for providing the sampling and monitoring basic to the preservation of a quality environment. Dr. Edward Epstein, our Associate Administrator for Environmental Monitoring and Prediction, will discuss these matters in detail.

This is nowhere better illustrated than in planning for offshore energy and industrial development. Environmental services to assure the safety of day-to-day operations, the establishment of criteria for engineering design, and protection against contamination are top-priority requirements, and NOAA is moving to meet them by increasing its marine services.

Among the phenomena of greatest concern to offshore developers is the hurricanes, whose potential for death and devastation needs no explanation here. These are ocean storms whose monitoring and prediction receive our closest attention. NOAA and NASA will launch, in May, the prototype of the first operational synchronous satellite which will allow us to keep continuous watch on hurricanes and other storms. Ultimately, we shall operate a system of two synchronous satellites in conjunction with three others to be operated by other nations as part of a global system. Our budget before the Congress seeks an increase of \$6 million for this key program. This, however, is not all; NOAA is significantly improving its coastal disaster warning efforts. In this connection, we seek an increase of \$5 million for new radars, improved communications and better community preparedness in fiscal 1975.

One of our brightest hopes in the oceans is to develop their potential as avenues for working with other nations. In mankind's concern for the competitive features of the global sea, it is easy to overlook this facet of ocean activity. However, we have been working to engage other nations in mutually beneficial cooperative activities, and I should like to mention three outstanding examples of this international cooperation and collaboration.

This June, the largest armada of vessels ever assembled for peaceful research will be deployed in the equatorial Atlantic, between the coasts of Africa and the Americas in what we believe to be the largest international cooperative undertaking in the history of science. There will be 35 to 40 vessels from 13 nations—14 supplied by the Soviet Union, 3 by the United Kingdom, 2 by the Federal Republic of Germany, 8 by the United States.

The ships will be supported by satellites, by aircraft, by radar, by land stations, by a host of scientific and technological talent from many nations to study the oceanic and atmospheric conditions leading to the formation of hurricanes and the large-scale atmospheric circulations that produce such tragic manifestations as the drought now ravaging the Sahara's Sahel region.

Some years ago, Presidents Nixon and Pompidou signed an agreement for cooperative efforts between the United States and France in oceanography and other fields. This summer, the oceanography program will culminate in a deep-sea exploration which verges on the fantastic. French and American scientists in French and American submersibles will descend 12,000 feet to explore the Mid-Atlantic Ridge, the most prominent geological and geophysical feature of the mid-Atlantic. This effort is supported by the National Science Foundation, the Navy and NOAA, with the Woods Hole Oceanographic Institution directing the scientific effort for the United States.

Most recently, as a result of the agreements signed by Secretary Rogers and Mr. Gromyko of the U.S.S.R. last June in Washington, a joint U.S.-U.S.S.R. committee has met to plan joint projects. We have agreed upon eight undertakings in six areas of oceanographic effort.

Cooperative international programs, such as these, demonstrate the great opportunities for the building of friendly relations through sharing of time, talent and resources. We hope to see the trend continue and grow.

These have been some of the points of significant accomplishment in the oceans in recent months made possible by the focusing of interdisciplinary talents within one organization. I hope you will find them as exciting as I do.

NOAA witnesses following me will provide greater detail.

I shall be happy to answer any questions you may have on these or other matters pertaining to NOAA.

Thank you very much.

Mr. DOWNING. Thank you, Dr. White, for an excellent resume of NOAA's activities.

I think it would be expeditious if we just went to the next witness and we will come back and ask questions of all of you.

Mr. Wallace, you may proceed.

**STATEMENT OF DAVID H. WALLACE, ASSOCIATE ADMINISTRATOR
FOR MARINE RESOURCES, NATIONAL OCEANIC AND ATMOSPHERIC
ADMINISTRATION, DEPARTMENT OF COMMERCE**

Mr. WALLACE. Mr. Chairman, my name is David Wallace.

I am Associate Administrator for Marine Resources of NOAA.

I have with me the other witnesses who will be following me, and I would like to present them to you at this time.

On my left is Dr. Edward S. Epstein, Associate Administrator for Environmental Monitoring and Prediction; on my far left is Dr. Robert B. Abel, Director, national sea grant program; and on my right is Dr. Robert W. Knecht, Director, Office of Coastal Environment.

I have a prepared statement I would like to submit to the committee. Since it is rather lengthy, I would request permission to submit it for the record and then touch upon its highlights from my notes.

Mr. DOWNING. I think that would be excellent.

Without objection, your entire statement will be made a part of the record at this point, and you may proceed with your own summary.

[The statement follows:]

STATEMENT OF DAVID H. WALLACE, ASSOCIATE ADMINISTRATOR FOR MARINE RESOURCES, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Mr. Chairman and members of the subcommittee: It is a pleasure to appear before you today and have the opportunity to review the marine resource programs we have been developing—specifically those concerning our fisheries, mapping and charting, and energy and environmental protection related activities. Our Sea Grant and Coastal Zone Management programs, although they are essential elements of our marine resource program, will be discussed separately by Dr. Abel and Mr. Knecht, respectively. While I will defer to them to discuss their programs, I wish to emphasize that we consider them to be vital elements in our link to the states and academic communities which must be partners with NOAA in the development of any meaningful national marine program.

As I noted before this Subcommittee in November 1972, at our last oversight hearing, our primary focus for marine resource development is in waters close to our shore approximately to the edge of the Continental Shelf. With the increasing demands for energy, with the interest in locating major facilities such as ports, power plants, and airports offshore, with the concerns for the impacts of dumping upon our coastal regions, and with the growing recognition and desire to properly develop and manage the coastal zone and the marine resources, this emphasis has continued and will be our primary area of concern in the foreseeable future.

Within this perspective, I would like to elaborate briefly on the highlights of our programs and their future directions.

FISHERIES

As a Nation we must conserve our fisheries resources and insure a fair share for our domestic fishermen. We need to create management systems which will assure simultaneously sustained availability of fish and an encouraging commercial climate. Creation of such systems requires wisdom, ingenuity, and dedication by all concerned. Our foremost goal is to secure appropriate national and international control of the common resource through such systems.

We believe it essential to improve the framework of international law in which resources are managed. An excellent opportunity to achieve such improvements will be provided by the Law of the Sea Conference which will begin substantial work in Venezuela this June. NOAA spokesmen have attended all meetings of the United Nations Committee that has been preparing for this conference. We have given strong support to the position of U.S. Delegations that resource management should be adapted to the characteristics of the resource concerned. Thus, we have advocated that coastal countries should be given full management authority over coastal and anadromous species, while international bodies should continue to manage the highly migratory species such as tuna which are beyond the capacity of any one country to conserve.

NOAA is also actively supporting existing international conservation and management activities, pending the development of new concepts of international law. We participate in eight international commissions given responsibility under treaty agreements to manage and conserve marine resources in various areas of concern to the United States. We have also assisted in the negotiation of twelve bilateral fishery agreements adapted to specialized management problems, nine of which have been concluded or renegotiated since 1972.

Significant progress toward a conservation program related to the entire ecological system rather than to isolated parts was made in October 1973 when the International Commission for the Northwest Atlantic Fisheries (ICNAF) agreed on overall catch quotas limiting the total amount countries fishing off the U.S. North Atlantic can harvest for the next three years. The overall quota is imposed over and above individual species quotas. This two-tier system represents a significant new approach to fisheries management. This conservation objective will be achieved while our own fishermen will be afforded the opportunity to increase their own catch during the same period of time.

The ability of massive factory fleets to deplete fish stocks in only one or two years, particularly in traditional fishing areas for U.S. fishermen, underscores

that the need for sound management practices which we strive for through domestic as well as international systems. Recommendations for the management of stocks in turn must be based on the best scientific research to lend force and credence to our position in international negotiations. We initiated the Marine Resources Monitoring and Prediction Program (MARMAP) to provide the required rapid, systematic, and comprehensive information on the status of fish stocks.

The program is a major element of our research presently underway at 10 NMFS fishery centers and laboratories around the U.S. The objective of MARMAP is to provide information on the abundance, distribution, and conditions of fish stocks of interest to the U.S.

Major program elements include investigations on the effects of fish catches on the stocks, development of technology for rapid assessments of fish stocks, and systematic survey operations in all major fishing areas. The program is cooperative, incorporating the capabilities and resources of other Federal agencies, universities, the fishing industry, and other nations. It is worth noting that we have been exploring a wide-range of techniques in our resource research. Habitats and submersibles from our manned undersea activities have been employed; we have been working closely with NASA on the detection of schools of fish from aircraft and satellites; and we have been exploring the possibility of hydroacoustic techniques for locating and counting pelagic fish.

The program now provides information on the status of fish stocks for the bilateral agreements and international commissions to which the U.S. is party. More assessment information is required for more fish populations on a more rapid time frame now than ever before. As factory fleets devastate stocks, we no longer can depend on traditional methods of measuring fish stocks on a species by species basis. We need to maintain these resources by limiting catch and/or effort for groups of species in a given geographic area, as demonstrated successfully last year off New England. MARMAP will provide the necessary fishery and environmental data for expanding this approach to sound management in other regions.

In its initial stages, emphasis was given to coordinating stock assessment efforts in the U.S., establishing comparative sampling and operational methods, which incidentally have been adopted by FAO and several nations operating off the northeast coast including the USSR; expanding fish-catch analyses; and expanding survey operations.

Knowledge of the condition of fish stocks developed by MARMAP will enable us to negotiate effective conservation agreements with other nations and assist us in resolving domestic problems of allocation.

In 1972, we began a cooperative State-Federal program effort which has the objective of providing the basis for institutional arrangements for unified management across jurisdictional boundaries and complements our international efforts. A series of management studies subsequently has been implemented throughout the coastal areas of the United States. Significant progress has been made in the development of a coastwide management plan for the American lobster. A Regional Marine Resource Council composed of State fisheries directors and the National Marine Fisheries Service has developed regulatory proposals which are being adopted, or being considered for adoption by the 11 Atlantic coastal States from Maine to North Carolina. Interim cooperative regulations between several States concerning the harvesting of Gulf of Maine shrimp have been adopted as a consequence of a joint State-Federal management study which identified the need for such measures. Further examination of management needs are underway for menhaden for the Gulf of Mexico and other species on the west coast and in Alaska, such as the Dungeness crab and the king crab.

In addition, the "High Seas Fisheries Conservation Act of 1973", which would implement the 1958 Convention on Fisheries and the Living Resources of the High Seas and would provide the Secretary of Commerce with the authority to cooperate with the States in developing and enforcing fishing regulations on the high seas, was introduced in the Congress on February 27, 1973. We are aware of the hearings that have been held on this legislation by the Subcommittee on Fisheries and Wildlife Conservation and the Environment. We are sensitive to the objections of industry and others interested in fisheries conservation. We are hopeful that some of these concerns can be reconciled, since we believe that in the long term, adequate authority must be approved for management of our fisheries beyond the three-mile limit.

Our resource management responsibilities have been broadened through the efforts of the Merchant Marine and Fisheries Committee by the passage of the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. At your last oversight hearings we had just assumed our responsibilities under the then just adopted Marine Mammal Protection Act of 1972. Close coordination with the Department of the Interior was effected immediately and coordinated general regulations went into force on December 21, 1972. Under the economic hardship exemption provision of the Act, 60 requests were processed of which 22 were granted. Since the Marine Mammal Commission and its Committee of Scientific Advisors has become operational we have been processing permits for display and scientific research under regulations and procedures previously established. To date, we have received 73 applications covering a wide range of species and projects, and thus far 11 have been approved and 2 have been denied. We have submitted two reports and two studies to Congress as required by the Act. Before passage of the Act, an intensive study of gear and fishing techniques was begun in regard to incidental take of porpoises during tuna seining. These studies have been intensified and results have been most encouraging as has been pointed out by Dr. White. Interim regulations governing the incidental take of marine mammals during commercial fishing operations were adopted on January 22, 1974. These regulations will be effective between April 1, 1974, and October 20, 1974. We are currently developing the required Environmental Impact Study (EIS) prior to issuing final regulations which, besides certain gear modification and fishing techniques, will require permits.

We also have maintained a vigorous role in support of international marine mammal conservation. At the 1973 meeting of the International Whaling Commission, the U.S. drive to establish further conservation measures for Antarctic whales, including lower quotas and a three-year phaseout of fin whale harvesting, was supported by the needed three-fourths of the Commission membership. NOAA has exercised a role of leadership in developing and promoting the strong U.S. position with Dr. White serving as the U.S. Commissioner on the IWC. We will continue to do so, bolstered by new information on assessment and biology of whale stock developed under its expanded research program.

Our agency is also responsible, by international agreement, for the management of the Pribilof Islands northern fur seal herds. The extensive Pribilof Island-Bering Sea research program, centered around St. George Island as the research control area, will move into its second year of operation. The program, implemented last summer after North Pacific Fur Seal Commission approval in March, will be substantially augmented this year and will expand the scope of behavioral and population studies based on last year's preliminary efforts. More intensive comparative studies of unharvested (St. George) versus harvested (St. Paul) populations are needed to adequately determine the factors that affect survival and abundance so that the herd can be effectively managed at environmentally optimum levels.

Research on new gear and methods to prevent incidental porpoise mortality in the eastern tropical Pacific yellowfin tuna fishery has met with considerable success. New gear such as a torque-balanced purse cable and new current meter device have been developed in conjunction with a new method of holding the net open using the small speed boats deployed in purse seining, and promise to achieve major reductions in gear malfunctions, a primary cause of porpoise mortality. The new gear and methods combined with standardization of the backing-down operation and use of the fishermen-developed small mesh safety panel, present an encouraging outlook for a significant reduction in porpoise mortality in the near future. NOAA also has under study a new design for a purse seine that may not only help reduce porpoise deaths but may improve fishing as well.

We intend to continue our porpoise research program beyond the two-year waiver period in an effort to more accurately determine population sizes and impact of the incidental kill as well as to reduce the kill to as close to zero as is feasible.

New responsibilities for the protection of endangered species of marine mammals, fish, and other species of marine animals and plants have been assigned to NOAA through the recently enacted Endangered Species Act of 1973. This agency is currently developing a strong and vigorous program including research, enforcement, and State-Federal cooperation leading toward the protection and restoration of threatened and endangered species under our

jurisdiction. Our efforts are being developed jointly with the Department of Interior in all areas of this important Act.

In addition to conserving and managing our fisheries resources, we provide many services to foster the growth of our industry and insure the quality of products at fair prices to the consumer.

During 1973 a cooperative development program was initiated with industry to increase the levels of underutilized fishery harvests by United States fishermen while encouraging the use of products from these fisheries.

In the Southwest Pacific, we have joined forces with the Pacific Islands Development Commission and the domestic tuna industry to develop the large and underutilized skipjack tuna resources. This project will hopefully contribute to employment in the Pacific Islands, provide U.S. processors with needed sources of raw materials, and reduce overcapitalization in the tuna fleet.

In New England, another fishery development program was initiated in cooperation with the industry to develop a \$10 million a year domestic industry by 1978 through utilization of Jonah and red crab, squid and hake. I am pleased to report that since the fall of 1973 about 1.5 million pounds of these products have already been placed in commercial channels.

To extend the supply of fishery products and maintain acceptable products on the U.S. markets, we have been working with industry on the use of minced fish blocks (March 25 issue of *Northeast* has an excellent article describing this effort). We also have undertaken a project with the knowledge and support of the Food and Drug Administration to resolve the problem to consumers, the trade and regulatory agencies in naming fish and fishery products used on a national basis.

We also are exploring the potential of aquaculture for expanding the resource base available to us. This is a major element of the Sea Grant program which Dr. Abel will describe, but I am also pleased to report that it is an integrated NOAA program drawing upon our excellent in-house NMFS expertise and the Sea Grant institutions for a unified approach to the needed research and development.

Last one be left with the impression that our fisheries efforts are all commercially oriented, I would like to point out that not only are our MARMAP and State-Federal programs also concerned with marine game fish species but we have a strong need and legislative responsibility to meet the growing demands of the Nation's recreational fishermen.

A second laboratory facility to address the marine recreational fisheries needs in the Gulf of Mexico was completed at Port Aransas, Texas, in 1973, and is being staffed. We also have rearranged our priorities and are developing additional research at our east coast research centers to address the serious problem in the status of the Atlantic Bluefin tuna stocks. Further, we are striving to improve our communication with sport fishermen and the many constituent groups concerned with our Nation's fish stocks in order to improve our responsiveness to their needs. Notably, a Marine Fisheries Advisory Committee (MAFAC), composed of representatives from such groups, advises the Secretary of Commerce. This Committee is providing a vital link to the many interested groups and valuable advice in the formulation and assessment of our programs. A special sport fish subcommittee has been created to review the National Marine Fisheries Service recreational fisheries activities, and assist that agency to develop programs of specific value to the recreational fisheries interests.

In summary, our goal in fisheries is to press aggressively to establish a management regime which will insure high levels of production and at the same time will reserve a maximum share of the stocks for our domestic fishermen, both commercial and recreational.

MAPPING AND CHARTING

Our role as one of the two major civil mapping agencies, the Geological Survey being the other, was brought forth in the recent *Report of the Federal Mapping Task Force on Mapping, Charting and Geodesy* under the direction of the Office of Management and Budget. This report, which I commend to the Subcommittee endorsed the marine mapping and charting programs we have undertaken and I would like to outline them briefly for you.

We must meet the increasing demands of maritime commerce, of recreation, of offshore industry, of growing coastal development, as well as the many other users of our products. A recent review of our nautical chart production for

1973 has shown a distribution of over 1.7 million of our charts, which prior to World War II, in 1939, was only 324,000 charts, and in 1960 was 1.1 million. These charts, which number some 971, are for the waters off our coasts and waterways, our harbors and the Great Lakes. With the growing demands both for new charts and greater production, we are looking at new methods of productivity and at the type of charts to be most responsive to our users.

We have initiated a program of chart automation to increase our efficiency of operation and reduce costs. In the past year, we produced our first two computer-assisted charts which cover a portion of Mississippi Sound and Pascagoula Harbor. We now have such computer-assisted charts being researched and reconstructed for the entire Gulf area; and it is our present plan to have in operation by 1980 a completed computer-assisted nautical charting system for all remaining areas.

Last year, we also initiated a major project, the Southern Coastal Plain Experiment (SCOPE), being carried out by the National Ocean Survey in the coastal waters off northern Florida, Georgia, and South and North Carolina. Project SCOPE is designed to compress within two years projects which had previously been programmed for the next 15 years. Its objective has been to provide marine information on the coastal plain region which will aid Federal, state, local and private agencies in making decisions concerning environmental problems. Aerial photographs are being taken of the coastline for use in coastal zone activities and to help delineate the high and low water lines for use in the compilation of nautical charts. Surveys are being conducted of sea bottom topography, tidal conditions and physical properties of the waters along the coast and in the Gulf Stream. SCOPE field operations are scheduled for completion by November of this year with all data for the entire project available 12 months thereafter on hydrographic and circulation surveys and on tidal surveys (inshore, continental shelf and deep sea). Considerable data are already available from last year's operation.

The emphasis upon offshore energy development also has called upon our mapping and charting services through assistance to the Bureau of Land Management (BLM). At the request of BLM we have in production bathymetric maps for new lease areas in the Gulf of Mexico for their use in leasing and managing outer continental shelf lands. The offshore petroleum industry also has indicated the need to extend seaward our horizontal geodetic control network in the Gulf of Mexico. With the seaward extension of petroleum development, it is increasingly important that adequate control be used for positioning platforms in these areas. In January of this year we initiated operations from two offshore platforms in the Gulf of Mexico to assist the petroleum industry in meeting its positioning requirements. We intend to extend such operations in the future.

With the growing development of our coastal regions, our mapping and charting activities, particularly the basic data such as sounding sheets and aerial photographs, are daily finding application. This is an important adjunct to the coastal zone management program to be discussed by Mr. Knecht.

ENERGY RELATED EFFORTS

Our response to the needs for assistance in addressing the Nation's energy needs has involved more than the aforementioned mapping and charting activities. Essentially all of our programs have made contributions to the related studies sponsored by the Council on Environmental Quality. Sea Grant was the major contributor to the environmental portion of the deepwater port study. We are now active participants in the ongoing studies on offshore floating nuclear powerplants and on the development of the outer continental shelf for gas and oil. We have been contributing environmental descriptions and environmental analyses as elements of these broader studies.

We also have been working in collaboration with the Geological Survey in the preparation of the environmental impact statement for the Santa Ynez channel area; and another cooperation effort with the Geological Survey has just been initiated to develop needed environmental baseline studies for the Bureau of Land Management for candidate lease areas. The major role of NOAA in these and other federal energy related programs is to provide the necessary data and analyses regarding the environment, particularly with respect to living resources, so that environmental consequences can be addressed in deriving policy decisions for the development of offshore oil and gas resources.

MARINE ENVIRONMENTAL PROTECTION

NOAA must assume a watchdog role over man's impact upon our environment, particularly with regard to our fisheries resources. Under the authority of the Fish and Wildlife Act of 1956, the Fish and Wildlife Coordination Act, and the National Environmental Policy Act, the National Marine Fisheries Service working with the Bureau of Sport Fisheries and Wildlife of the Department of Interior, influenced environmental decisions on 260 Federal sponsored water resources related projects, licenses or permits in the last fiscal year. This has resulted in avoiding or substantially reducing damage to about 100 thousand acres annually of estuarine and inshore fisheries habitat. Passage of the Marine Protection, Research and Sanctuaries Act and the Federal Water Pollution Control Act Amendments of 1972 have greatly expanded the scope of our responsibilities under the Fish and Wildlife Coordination Act.

In response to Title II of the Marine Protection, Research and Sanctuaries Act we also are about to transmit the *First Report to the Congress on Ocean Dumping and Other Man-Induced Changes to Ocean Ecosystems* and are working with other agencies to establish dumping criteria, developing baseline studies and assessing the adequacy of the Federal effort dealing with pollution and other man-induced effects.

The comprehensive marine ecological investigation, MESA, which was initiated last year in the New York Bight to investigate the coastal waters from Montauk Point, Long Island to Cape May, New Jersey, has been focused on the apex area off the entire New York Harbor where the dump sites for the New York-New Jersey metropolitan region are located. Although this is a five-year program, we recently were able to advise the Environmental Protection Agency on the status of the current dump site, the spread of sludge from the existing site and possible alternative dump sites for this region. As time progresses we expect this project to be responsive to other growing demands for environmental information to assess the impact of development in that region. We are ready to assist States in carrying out their water quality monitoring responsibilities by providing technical advice on request.

Another developing need for environmental assessment concerning the mining of manganese nodules from the deep-sea floor has resulted in a cooperative study involving our agency, industry and academic institutions. The potential for the development of these manganese nodule resources by the U.S. companies and other foreign organizations is real and underway. In support of the U.S. development of the resources, we have initiated a baseline study of the marine environment in the tropical Pacific to provide the scientific basis for predicting and assessing the effects of future mining operations and for developing guidelines to assure that such operations are environmentally acceptable.

In addition to carrying out our own programs for assessing environmental modification, it should be noted that our Environmental Data Service provides a valuable service to other, similar government and private sponsored investigations. We have negotiated data management and exchange agreements with other agencies to centralize the vast amounts of data and information obtained by the federal programs as a means of improving our services to meet these needs.

INTERNATIONAL

Although our major ocean emphasis is in coastal areas, we would also like to note that we also actively participate in international oceanographic endeavors. Besides our participation in international fisheries investigations, we provide the national leadership in the Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR) sponsored by the Intergovernmental Oceanographic Commission (IOC); we are the United States Executive Agent for the recently concluded US/USSR Agreement on Cooperation in Studies of the World Ocean, and our scientists are developing projects with their Soviet counterparts under this Agreement; and we are the national focus for the US-French and US-Japan bilaterals for marine affairs. We firmly believe that such international collaboration complements and contributes immeasurably to our national programs and we are working with our other Federal agencies toward this end.

In summary, Mr. Chairman, I am convinced that only by bringing together the ocean elements of NOAA as was accomplished by Reorganization Plan No. 4, are we today able to have the foundation for addressing the marine resource activi-

ties briefly outlined above. I would be pleased to answer any questions you may wish to ask concerning the programs I have just described.

Mr. WALLACE. Thank you, sir.

I am going to touch upon some five items in our ocean marine resource program.

These will cover fisheries, mapping and charting, energy related efforts, marine environmental protection, and our international involvement in oceanography.

In terms of our fisheries, NOAA and the Department of Commerce have established certain goals which we are trying to pursue. The goals are to conserve and develop our fishery resources, to insure a fair share of these resources for our fishermen, to create management systems to give the optimum economic yield for our commercial fishermen, and to provide the proper framework for the preservation and development of our recreational fisheries.

Within this context, I would like to mention several important elements of our fisheries programs.

One is the international arena in which the United States is deeply involved, particularly affecting our coastal water fisheries and, in some cases, our distant water fisheries.

We also have domestic problems of fisheries management, and I would like to touch briefly on both of these topics.

In international relations, the United States is involved in eight international commissions, ranging from ICNAF, the International Commission for Northwest Atlantic Fisheries, to the IMPFC, which is sort of its counterpart in the Pacific Ocean, and the Inter-American Tropical Tuna Commission. I am citing these as the kinds of commissions in which we are involved.

We also have some 12 bilateral agreements with various countries who have been involved in fishing off our coasts. I would like to touch upon the activities in ICNAF as an illustration of the kind of thing that can be accomplished through an international commission.

Two years ago, the United States, in reviewing the problems of ICNAF, presented a program which was designed to bring under control the unrestricted fishing which was taking place off our Northwest Atlantic coast. In June 1973, the United States took a very strong position that an appropriate conservation program had to be developed to preserve these fisheries. In October 1973, we are able to establish for the first time a complete quota system covering the entire species involved in the Northwest Atlantic. The purpose of this was to reduce as rapidly as possible the total fishing effort so that the stocks of fish which were being rapidly depleted would have an opportunity to recover. Our aim was to do this and, at the same time, provide opportunities for our own domestic fishermen to continue to fish and to increase their share of the take.

I think it is a major accomplishment that we have been able to set up a time-frame plan to accomplish this goal. By 1975, we will have under management, at the level of maximum sustainable yield, all of the species that are involved in the Northwest Atlantic. At the same time, our fishermen's share will be increased as our capability for fishing is developed.

This is a rather optimistic development in this one Commission. I must say, in all candor, that the same kind of optimism cannot be ex-

pressed for others of our international commissions. We have had serious problems in the northern Pacific in dealing with the problem of our salmon which migrate far out of the Pacific during part of their life and then return to the streams to spawn.

We have had major difficulties with the Japanese in relation to their take of these fish. As a result of the intensive fishing, we have had a major drop in our runs of Bristol Bay salmon. At the moment, we are taking a very hard line in this Commission, hoping to bring about a breakthrough which will give us the opportunity to appropriately manage this major U.S. fishery. But I must say at this point, I cannot be optimistic about where we will finally go.

Now, one of the things I would like to touch upon in terms of these international commissions is the necessity to have highly sophisticated methods of assessing the size of the stocks. Without such assessments, it is impossible to manage the stocks. And as a result of this, we have had, since 1972, our marine resources monitoring and prediction program, called MARMAP. MARMAP is designed to indicate the size of the stock and the fluctuations in the stock, and to give us an adequate basis for our scientific research.

We have had some difficulties in carrying out the total concept of MARMAP. But we are using innovative ideas, such as submersibles, for example, in assessing some of these stocks. We are developing hydroacoustic techniques to look at the fish in their environment, as well as the standard methods. With these, we believe it is possible to have the proper scientific base for these management programs.

I would like to touch now upon our State-Federal program of fisheries.

This was started in 1972. We have already developed programs in various parts of the country. For example, along the east coast we have a plan which has been developed jointly between the States and the Federal Government on the Gulf of Maine shrimp and on the lobster. On the gulf coast, we have been working on the development of a plan for the menhaden and the shrimp; on the west coast, the Dungeness crab and king crab.

One of the big problems we have in our whole management structure is the inability of the Federal Government to manage those waters which are beyond the States' jurisdiction. In February 1973, we proposed a bill called the High Seas Fisheries Conservation Act. This bill has been before the Merchant Marine and Fisheries Committee. We have had some problems with it, and yet, if we are going to carry out in the long run the kind of management program that must be done, if we are to assure the maximum level of productivity for our fisheries, there must be some technique by which the Federal Government can participate in a management program.

We are looking at this legislation now in terms of criticisms and objections which were submitted by various segments of the industry. We would hope that somehow we can work out the appropriate arrangement so that some legislation of this type can be put into effect, because down the road, no matter which way we go in this international matter, there must be some form of management authority. The only management authority we have now gives us the authority to prevent foreign fishing in a zone from 3 to 12 miles. In addition, there is what-

ever authority we might have in relation to the international agreements to which we are a party.

I would like now to switch to fisheries development for just a moment, because this is another aspect of dealing with the total fisheries problem.

In the Northeast, we have developed a program to utilize underdeveloped species. We have been concentrating on squid, hake and two species of crab. This looks promising, and already it is beginning to pay off in results.

Another aspect of our efforts I would like to touch upon is marine sports fishing program. This has been a relatively new effort that has not been a strong program. But we are pushing very hard now to elevate this because of the great importance of this vast recreational fishery to the United States.

I would now like to switch to our programs in mapping and charting. Our National Ocean Survey is one of the two major civilian mapping agencies. The other is the Geological Survey.

Just recently, there was a report issued by the OMB directed Federal Mapping Task Force on Mapping, Charting, and Geodesy, and Surveying. In this report there were key things which the task force felt were essential to carry out the responsibilities under our authority.

I would like to talk just briefly about nautical charts. Nautical charts are used in marine fishing, commercial fishing, in almost everything that uses the seas.

In the last 10 years, our number of nautical charts has almost doubled. We now, in 1973, produced 1.7 million of these charts. In order to meet the growing demand and cover all the areas of the United States, we have embarked on an aggressive program to automate this total chart making. In the last year we have, for the first time, been able to produce automated digital charts directly, greatly reducing the manpower that is necessary. We would hope by 1980 to have all of our charts on the same basis.

In our National Ocean Survey we are always trying to concentrate our efforts in specific areas. We have selected one area off the southeast Atlantic for which we have a project called SCOPE. In 2 years, we are trying to do all of the things that we had planned to do in that area in terms of tides, establishment of high and low water marks, bottom topography, and physical properties of the water in that area. In 2 years' time, we would take this concentration of NOAA resources to another area. In this way we feel we can greatly expedite this kind of collection of data.

We have also been involved in offshore energy development. One of the problems that we had had in the adequacy of bathymetric maps, a very important component of this. We have been requested by the Bureau of Land Management to work with them in development of appropriate bathymetric charts as part of the energy development program.

Also, in relation to the energy problem is the matter of geodetic control on the water. In the Gulf of Mexico, we have just started to extend our horizontal geodetic control to the offshore waters.

Mr. Chairman, I would like now to just touch upon environmental protection.

We have a major program called MESA. You will recall that Dr. White has already highlighted it for you.

Under the Fish and Wildlife Coordination Act, under the National Environmental Policy Act, and most recently under the Coastal Zone Management Act, we have major responsibilities. This is a very major problem area. It has been one that has been plaguing us in many ways because, up until now, we have had limited capability to deal with this environmental protection; and yet, if we cannot maintain the marine environment habitat, there is the possibility of deteriorating from a number of potential and competing uses.

The last item is our international agreements. Again Dr. White touched upon this.

I am not going to elaborate further, but would be very happy to supply additional information if the committee should so desire.

Thank you.

Mr. DOWNING. Thank you very much, Mr. Wallace.

Since our colleague, Mr. Mosher, has to leave for another meeting, we would like to interrupt the schedule of the witnesses to allow him to make a statement.

Mr. MOSHER. Thank you, Mr. Chairman. That is very courteous of you.

It seemed to me that Dr. White's testimony had a lot of buoyancy to it, a lot of positive, affirmative, and optimistic remarks.

I guess that is characteristic of the man, and that is why he is a good leader in NOAA.

However, you begin to wonder, are there not any problems? There were not any indicated in his testimony.

Mr. Wallace has just hinted at a few in his area.

Bob, on your first page you talk about a larger national drive. What are your problems? What about the overall momentum as related to what we were hoping for 3 years ago or 4 years ago?

I know you are not content. If you are content, you ought to be fired.

Where can we pick up the momentum and do better? Do you have any suggestions for this committee, maybe some suggestions you want to make in writing, but we will certainly welcome them.

Are we doing as well as we should?

Dr. WHITE. Mr. Mosher, I think we are doing as well as we can with resources that are available to us, and I think we are putting them into what we consider to be the highest priority problems that face us within the statutory responsibility of NOAA.

Mr. MOSHER. You are talking about the overall budget constraints that plague us all?

Dr. WHITE. That is all. The ocean program has got to fit into a total overall national context. Now, what that means, of course, is that there are many other kinds of activities that we have proposed because we believe they would be very worthwhile undertakings, but for which resources are understandably not available when considered in the framework of the total financial picture.

Taking a look at the key problems that this Nation faces that could be benefited by, or partially solved by efforts in the oceans, I can list a number, and then point out where I think that benefits would accrue from efforts.

Let us take the problem of living resources of the sea: fisheries.

It is quite clear here that we need the strongest kind of push if we are going to manage these fishery resources in some sort of rational way. Mr. Wallace has indicated that even the simple statutory authorities for allowing such management do not exist.

What we are doing is trying to move ahead with what authorities are now available to us to do the best we can, as for example in the State-Federal management program. But there are many areas that could, in my opinion, be increased in effort.

I think we would be much better off in our international negotiations if we had more accurate and broader fish stock assessments. Negotiations on fisheries is based fundamentally on what the facts show: are those stocks low, getting low, or decreasing/increasing? If you do not have adequate data, it is difficult to go into such negotiations. I think there is a need for broader attack on the whole problem of the assessment of our fisheries resources. There is a whole area, for example, of agriculture. I think there is great potential and considerable room for effort.

I am not saying we are not devoting effort to these. We are devoting significant effort, but within the limits of resources that are available to all of us, and we are always operating under such limits.

We can move to other areas where additional information is needed. Perhaps the most urgent one now within the realm of our organization would be in the provision of the necessary environmental information that is going to be required if we are going to develop oil and gas resources on the Continental Shelf with proper concern and safeguards for the environment. We are going to have to have the best data possible and I think there is a need for a larger effort. In this connection, I should point out, in connection with the President's energy program, that additional resources being put into this through various agencies, and we would hope to work with those agencies.

If you go to the question of the protection of the environment, you have to ask yourself whether we have adequate monitoring systems and so on. I think while we devote considerable effort, we need improvements here, too.

There are other items too, where I can see benefits from additional efforts in oceanography. But my task in administering this organization is, having made the arguments and justifications for such programs, and realizing that these things have to take place within a larger national context, making the most effective use of the resources provided, and I would work within that.

Mr. MOSIER. You certainly have hinted, implied what I am getting at, that there is a lot we need to be doing, and I think crucially need to do, and we are not, and are not content.

You speak of "generally growing Federal ocean expenditures." You use that phrase on page 2. You mention an increase of \$22 million for fiscal year 1974 in NOAA's overall proposed budget.

How does that \$22 million compare with what you asked OMB for? Is that a proper question?

Dr. WHITE. I do not have the number I can give you now, Mr. Chairman. I can supply that number. It was greater than the money we finally ended up with within the President's budget.

Mr. MOSIER. I think we need to know what was requested.

Mr. DOWNING. Dr. White, do you mind supplying the committee that information, the amount you requested of the office?

Dr. WHITE. I can do that.

Mr. ROGERS. I think it might be interesting to have the request to the Department of Commerce, also.

Mr. MOSHER. That is really what I meant.

Mr. DOWNING. Can you supply that information?

Dr. WHITE. Glad to do that, Mr. Chairman.

Mr. MOSHER. For instance, in the coastal zone management effort, the \$12 million that is proposed through the 1970 budget is exactly the same figure that I guess you received in 1974, is that right?

Dr. WHITE. The total appropriation, Mr. Mosher, is the same in dollar amount, but it actually represents an increase for the management part. The sanctuaries part of the act is a 1 year authorization for which \$4 million of the \$12 million in 1974 was set aside. We intend to use approximately \$1 million in this fiscal year, and \$3 million in 1975. The \$12 million requested in the fiscal year 1975 budget thus provides an actual increase of some \$4 million in the amount of money that will be available for the program development grants and program administration grants under the provisions of the act.

Mr. MOSHER. I think nearly everyone in this room is aware of the struggle we had to get that original \$12 million. I am glad there is that much and some leeway in the budget.

Your figures indicate what NOAA requested, but include what the request was for the coastal zone management, I assume, the figures that you are going to supply the committee.

Dr. WHITE. We will supply that for the record.

[The information referred to follows:]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION FISCAL YEAR 1955
APPROPRIATION REQUESTS BY ACTIVITY

[Dollar amount in thousands]

Operations, research and facilities	Request to DOC		Request to OMB		Congressional submission	
	Perma- nent Positions	Amount	Perma- nent positions	Amount	Perma- nent positions	Amount
Mapping, charting, and surveying services.....	2,088	\$54,143	1,931	\$51,508	1,856	\$51,666
Ocean fisheries and living marine resources.....	1,453	56,973	1,437	54,260	1,394	51,431
Marine ecosystems analysis and ocean dumping.....	55	8,390	53	7,208	76	6,355
Marine technology.....	100	2,958	100	2,947	106	3,443
Sea grant.....	26	24,545	14	23,945	23	24,279
Basic environmental services.....	2,975	116,911	2,969	113,430	3,106	105,288
Environmental satellite services.....	820	66,221	820	66,247	734	63,742
Public forecast and warning services.....	1,843	56,505	1,816	54,578	1,570	49,116
Specialized environmental services.....	1,302	35,279	1,302	35,213	1,134	27,560
Environmental data and information services.....	487	12,405	483	12,180	510	13,009
Global monitoring of climatic change.....	25	1,038	25	622	47	1,307
Weather modification.....	79	15,853	77	14,849	81	13,963
International projects.....	66	9,397	66	9,994	83	8,724
Retired pay, commissioned officers.....		1,818		1,818		1,818
Executive direction and administration.....	935	23,543	935	19,049	930	21,905
Total, operations, research, and facilities.....	12,254	485,979	12,028	467,848	11,659	443,606
Coastal Zone management.....	14	14,445	24	12,000	10	12,000
Pribilof Island fund.....	80	3,937	80	3,937	80	3,937
Fishermen's guaranty fund.....	1	320	1	61	1	125
Promote and develop fishery products.....	(349)	(7,423)	(349)	(7,711)	(349)	(7,428)
Total, NOAA.....	12,349	504,681	12,153	483,846	11,750	459,668

Mr. MOSHER. Throughout your testimony you refer to President Nixon has requested, or President Nixon has proposed, and that sort of thing. I assume there is an implication there that what the White House and OMB are proposing in this budget is not exactly what NOAA would propose if they could, and so I take that as an indication there.

On page 7 you refer to a total request for the Sea Grant program of \$25 million. As I read the President's budget it was \$23.2 million. You are talking in very round figures here?

Dr. WHITE. No. It is \$24.3 million.

Mr. MOSHER. You are using round figures here?

Dr. WHITE. Round figures.

Mr. MOSHER. I guess the figure we have is \$23.2, and I am glad it is a little bit more.

Just one or two more brief questions, Mr. Chairman, or comments.

Where you speak of the large international armada of vessels that will be working in the area between the American Continents and Africa, is that sort of an international BOMEX? Will the techniques there be similar to BOMEX, or is it something quite different?

Dr. WHITE. It has similarities to BOMEX in that we are looking at the atmospheric regions over the ocean. BOMEX was looking at the rate energy gets into the atmosphere from oceans.

The project this June is directed at understanding how the energy, which is already manifested in the atmosphere, as cumulus clouds, is then organized into very violent circulations which we call hurricanes, and how that energy is organized in a way that effects the largest scale hemispheric weather patterns.

We are beginning to understand more and more of the absolutely critical role of the oceans in determining our large scale weather. For example, some recent experiments conducted at our laboratory indicate that if you assume a change of temperature in the Atlantic Ocean of a few degrees, and then calculate what would happen to the circulation, in this case over Africa because we are interested in the severe drought there, you get a rather remarkable change in weather patterns.

The whole purpose of this kind of experiment now is to get at quite a different problem than the one investigated in BOMEX.

Mr. MOSHER. Would this be an example nevertheless of where some of the BOMEX data, our own national program there, provides a useful impact and basis, foundation, for this larger international program?

Dr. WHITE. Yes, clearly. BOMEX was a model in the following sense. The basic information that was gathered in BOMEX will contribute directly into this experiment.

The whole scheme of operating a complex array of facilities like this will be largely built upon the lessons we learned in the operation of BOMEX. So it was basic to this experiment, even though its purpose was different.

Mr. MOSHER. I am also interested in the interrelationship between Federal agencies. What about SEASAT? And then on the next page where you talk about the synchronous satellite that will be jointly launched as a prototype by NOAA and NASA.

Is SEASAT a development of ERTS? Is it much the same technology that ERTS uses, or is this something different?

Dr. WHITE. No, it is a different technology. Let me contrast it this way. The sensors on the SEASAT are basically active sensors as opposed to passive.

This is an example where we, as well as other agencies have worked very closely with the Space Agency to define applications satellite technology to better fulfill our needs.

Mr. MOSHER. Well the philosophy of SEASAT and ERTS must be similar in that it is a constant watching—

Dr. WHITE. Yes, that is correct.

Mr. MOSHER. What about the budget? Is SEASAT in your budget or in NASA's budget?

Dr. WHITE. The development of the SEASAT prototype, the launching and provision for the data from it, are in the budget for the Aeronautics and Space Administration. The user agencies, such as ourselves, the Navy, and others who will want to use the information, will have to provide budget support in their own financial plans. It is our intention at NOAA to do that.

Mr. MOSHER. You will be a user agency?

Dr. WHITE. That is correct.

Mr. MOSHER. And the actual cost of getting it up and so forth, and developing it, the hardware, is NASA's budget?

Dr. WHITE. That is correct. I should emphasize this is an experimental satellite. It is regarded as a scientific satellite which will prove out the feasibility of these remote sensing techniques.

Mr. MOSHER. It is an example of coordination that I think is important, and should be encouraged by all of us.

Mr. Chairman, I will not take any more time.

Mr. DOWNING. We will turn to our next witness, who is Dr. Robert B. Abel, Director, national sea grant program, NOAA.

STATEMENT OF DR. ROBERT B. ABEL, DIRECTOR, NATIONAL SEA GRANT PROGRAM, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Dr. ABEL. Thank you, Mr. Chairman. It is a pleasure for me to appear again before this subcommittee to review some of the activities of the Sea Grant program and report to you on its progress toward the objective that you laid down in Public Law 89-688.

With your permission, Mr. Chairman, in the interest of time, I would like to submit my prepared testimony for the record.

Mr. DOWNING. Without objection, your entire statement will be made a part of the record at this point.

[The statement referred to follows:]

STATEMENT OF DR. ROBERT B. ABEL, DIRECTOR, NATIONAL SEA GRANT PROGRAM, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Mr. Chairman and members of the subcommittee, it is a pleasure to appear before you today to review some of the activities of the national sea grant program. We have progress to report in achieving the objectives with which you charged us under Public Law 89-688. I would like to submit a complete listing of accomplishments for the record. (Note: Item # 1 are the accomplishments (at-

tachments), with your permission, Mr. Chairman. For this statement, I have limited myself to a few highlights, selected to reflect our broad geographic dispersion and variety of activities.

In regard to geographic spread, let me refer first to our basic legislation. The National Sea Grant College and Program Act of 1966 describes our essential mission as follows, I quote: ". . . It is the purpose of this title to provide for the establishment of a program of sea grant colleges and education, training, and research in the fields of marine science, engineering, and related disciplines."

Mr. Chairman, it is a pleasure to report that, of the 30 coastal and Great Lakes states, Sea Grant now has productive, increasingly valuable programs in all but eight. Of the Sea Grant programs now operating, seven have achieved the status of Sea Grant Colleges. Nine are working under Institutional Support, developing the excellence and record of performance that will earn them Sea Grant College status. Eight are Coherent Projects, developing toward institutional status. We have one bi-state program in which Mississippi and Alabama have joined forces, and another forming between Maine and New Hampshire. California has both a Sea Grant College and a Coherent Project, and we have initiated a Coherent Project in Guam. In addition, we have 27 individual projects in 16 states, two territories, and the District of Columbia. With your permission, Mr. Chairman, I will submit for the record a listing of Sea Grant status by state. (Item No. 2.)

There are two principal reasons why the Sea Grant network is not complete. First, some states have not organized to meet the rather unique Sea Grant requirements, pooling their marine competence to meet our criteria. We are working with those states, to the extent of our limited staff capability. Second, some states have developed the core organizations, but we have not had sufficient resources to bring them into the system. Assuming that resources are available, we estimate completion of the Sea Grant network before the end of the decade. We consider this a priority task, not only because of the stated purpose in the Act, but because the existing Sea Grant programs have proved to be an extremely valuable resource to their states and regions, and the sum of their activities forms a truly national program from which the whole nation benefits.

In citing examples of accomplishment, I have chosen a mixture of activities, some of which are local or regional in their utility, and some of which have national value.

The continuing national problem of energy sources has stimulated a considerable impact of discovery and exploitation of petroleum in the New England region. recently completed a combined environmental and economic study of the potential effort in some Sea Grant programs. Massachusetts Institute of Technology The MIT Georges Bank Petroleum study became the take-off point for a number of specific studies submitted by the MIT Offshore Oil Task Group to the Council on Environmental Quality. Highlights of the MIT findings and a list of reports are included in the materials I will submit for the record. (Item No. 3.)

The Sea Grant Act charges us with giving preference to "practices, techniques, and design of equipment." One piece of equipment of which we are very proud is called the "Remote Undersea Fisheries Assessment System," RUFAS for short. RUFAS II is a shiptowed system that permits an operator on the supporting ship to "fly" the RUFAS platform around or over undersea obstacles while it remains at a controlled height above the bottom, taking pictures and sending a TV image back to the ship. Its purpose is to assess bottom and near-bottom fisheries resources. It is now on loan to the National Marine Fisheries Service (NMFS) for use in charting deep bottom fisheries. Mississippi State University developed RUFAS II with support from Sea Grant, the state's Marine Resources Council, and technical advice from NMFS.

A contribution to medicine was made by the University of Washington where Sea Grant scientists found a substance called "aequorin," which gives jellyfish their glow. The substance can be used for diagnostic purposes to measure miniscule changes in calcium concentrations in a person's body. Such changes are frequently early signals of cellular destruction in the body which point to onset of a number of important diseases. The jellyfish extract is far more sensitive than present methods and does not upset the balance of the patient's system.

The University of Washington Sea Grant Program has also produced a fine example of Sea Grant-Industry cooperation which resulted in the "Sequential Sea Mesh System" to clean ship hulls without putting them into drydock. The technique literally explodes barnacles and growth off a hull by use of an explosive mesh. In contrast to present methods of ship hull cleaning, which take a day or more, the Sea Mesh can be placed on the hull cleaned in about 2 hours. The com-

pany with which the Washington Sea Grantees cooperated is the Controlled Dynamics Corporation. This successful activity was funded for only \$5,000 and it is expected that it will be used commercially in the near future.

Picking sites for power plants is a vexing problem that has caused great stress in many communities. The State University of New York Sea Grant Program is providing the information base on which choices can be made. The New York team collects information on the actual functioning of cognizant agencies and their effectiveness, evaluates how power pricing policy affects economic growth, examines possible beneficial uses of thermal effluent, determines whether underutilized land space such as buffer zone and transmission corridors can be used for recreation or other purposes, measures effluent plume size and temperatures, estimates environmental impact, and makes all the information available to all interested parties. This valuable information will also be a great asset to the State of New York as they develop their coastal zone management program under the Coastal Zone Management Act of 1972. In a current case, the Sterling site on Lake Ontario, the Sea Grantees are also acting as a "friend of the court" in supplying information, without advocacy, on the environmental impact of plant siting.

The University of Miami's Sea Grant Program has an Ocean Law Program that exemplifies another area of interest. The Ocean Law Program includes the education of law students, legal research, and a strong advisory service program. The demand for students graduating from this program has been great, and we expect it to increase as energy and environmental problems continue to grow. The research results are disseminated through an advisory service called the "Community Legal Problem Services," which has the capability to respond to on-the-spot requests for legal research information from the committee serviced by the university. A list of reports issued, and their principal users, is in the material I have offered for the record. What does not appear as a report or as a specific user group, is the valuable background legal research service the university provides to the private community.

Two examples of fisheries technology are reported by our Sea Grant Colleges in Rhode Island and Texas. The Rhode Island Marine Advisory Service assisted the Point Judith Fishermen's Cooperative in developing two-boat midwater trawling for herring. The project was initiated with test runs in 1972. Last year the number of boats using the system increased to eight, and the herring catch was nearly doubled. Added catch value was nearly \$200,000. Cost to Sea Grant was about \$5,000. Texas A&M University worked with industry to test gear that would allow shrimp to escape while capturing finfish. The problem is that bay fishermen are prohibited from trawling six months of the year in order to protect juvenile shrimp that mature in the bays. By developing gear that protect the shrimp while capturing fish, there is a good possibility that the trawling season can be extended all year around, with high return on investment to the fishermen. In one three-hour experimental trawl, over a thousand pounds of edible fish were caught. This project is a good example of how Sea Grant can bring engineers, fisheries specialists, economists, and lawyers together to tackle a problem from resources to regulation and marketing. Further tests are needed before recommendations can be made to legalize use of the gear in Texas Bays.

Although markets exist for drum, sheepshead, mullet, croaker and whiting, such as were captured during the Texas experiment, these species are underutilized in Texas because of the short fishing season. But Sea Grant is also interested in underutilized species in other locations, and to bring all valuable species into the market we have a cooperative national program in which Sea Grant is working closely with NMFS. We already have accomplishments by Sea Grantees in the use of squid, mussels, and eels. MIT Sea Grantees are working to increase the harvest of squid off the East Coast from the present 20,000 pounds per year to four times that amount. The project involves marketing surveys, product development, and nutrition tests. The MIT scientists have demonstrated a machine to eviscerate and skin squid; the machine would allow processors to triple their production at low cost. The Maine Sea Grant Program, in cooperation with the Maine Department of Natural Resources, educated the consumer with respect to the blue mussel during the recent meat shortage. For the future, the researchers are developing culture methods that will reduce the incidence of mussel pearls and enable their live shipment in sufficient quantities to meet demand. The North Carolina Sea Grant program tackled the problems of harvesting, holding, purging, freezing, and shipping eels for export. In 1973, at least 50 fishermen were involved in eel harvesting and shipments totaled over 500,000 pounds with a gross value to the fishermen of \$250,000. At least one additional processing/freezing plant has

been established as a result of this project and another is in the planning stages. Handicapped persons were taught to make the eel traps for sale to the fishermen. Federal Sea Grant cost was \$7,300 matched by \$3,700 of local funds. North Carolina state agencies and a local exporter are cooperating.

The University of Hawaii Sea Grant College opened up a new precious coral resource. The Hawaii coral industry, which had operated at an estimated three to four million dollars a year, has grown to more than a ten million dollar industry as a result.

The Sea Grantees who located the resource are now advising on harvesting levels that will preserve the resource, and have also begun cooperation with Sea Grantees in Guam and the Trust Territories in search of additional precious coral resources. One such resource already has been found in the Palau District.

Aquaculture is one of the few fields specifically mentioned as a Sea Grant objective in our legislation. Our successes include pond culture of shrimp by Texas A&M, development of a system now being commercially applied of fully closed salmon culture by the University of Rhode Island, the extending of the net salmon culture program on which we reported last year to Maine and New Hampshire and several companies in Puget Sound, the first major steps toward culture of fresh water prawns in the marshes of South Carolina, substantial advances in American lobster culture in a unified program that involves Sea Grantees in three states and six institutions, development and commercial installation of oyster hatcheries in Virginia and Maryland by the Virginia Institute of Marine Sciences, and major successes in seaweed culture in California, Washington, and Hawaii. The "ocean ranching" of salmon deserves special mention. We have previously reported to the Subcommittee on the project at Oregon State University where chum salmon are spawned in a gravel incubator and go to sea, to be harvested on their return. We think this project has been successful, but our investigators are properly cautious because an unusually high natural return of chum salmon to the creek could be responsible for the increase in salmon. It will take a while longer for positive proof. However, there is no doubt about Dr. Lauren Donaldson's strain of what he calls his "Sea Grant Coho" at the University of Washington. As you know, a return of one half of one percent of hatchery salmon is considered quite good after four years at sea. Dr. Donaldson's Coho salmon returned in two years, at a rate of 2.5 percent. The Donaldson pond at the University has a capacity of only about 500 salmon. When nearly 2500 crowded into the little pond, Dr. Donaldson said he wasn't sure whether he had a success or a monster on his hands.

I could go on for the rest of the day with such examples, Mr. Chairman, but I think these will suffice to illustrate that we are getting the results for which Congress created us.

I would now like to relate to the Subcommittee a few on-going efforts, relating to the management of the Sea Grant Program within NOAA.

Our first long range plan was exceptionally well received, but was designed and issued four years ago, when the program was in its infancy, under the aegis of the National Science Foundation and partly the National Council for Marine Resources and Engineering Development.

My colleague, Harold Goodwin, is presently finishing up a second edition of the plan which reflects our new administrative environment and altered vistas. We expect to issue it some time this summer.

The Marine Advisory Service, under Howard Eckles' leadership has now been extended to 22 states, where 28 separate programs are involved. We expect to start three more programs this year which will help to complete a national network of Marine Advisory programs. During the past year over 50 major educational workshops were held. These reached about 6,000 individuals working in various aspects of Marine affairs. Responses to thousands of individual requests for information are given each year. Research and problem solving projects are carried out when needs are recognized. For example, the manner in which the Advisory program in Maine responded to a critical problem of lobster red tail disease is most dramatic. A description of this is submitted for the record, in a letter from the Maine Department of Natural Resources.

The Sea Grant International Study ordered by the Subcommittee in last year's authorization is proceeding. Professor Judith Kildow at MIT is director of the project. Her counsellors include Dr. Athelstan Spilhaus and Deans Warren Wooster and John Knauss. The project is on schedule; the report will be submitted to this Subcommittee in September of this year.

At the instigation of our Advisory Panel, we are undertaking sponsorship of a study to identify those marine technologies most likely to enhance this country's balance-of-trade position over the next decade. We were pleased to discover, later, that the newly created Congressional Office of Technology Assessment has assigned this topic highest priority.

At our last meeting, Mr. Chairman, you illuminated an area which for us has been a matter of concern since this program's inception: The publication process. The broad issue to which this relates is that of effective conveyance of Sea Grant's products and services to its potential consumer community. Owing to this program's unusually wide scope, however, that community is extremely diverse.

You specifically asked, Mr. Chairman, concerning our publications screening process. We have, since then, advised our Sea Grant Directors to apply even stricter surveillance to their publications programs, and in this connection, I would like to submit two documents for the record.

1. My note on publication in the scientific literature. (Item No. 6.)

2. My account of the session on publications during the Sea Grant Association meeting at Delaware (Item No. 7.)

I have also brought the matter before the Sea Grant Advisory Panel. Their counsel is that the Marine Advisory Service should be able to provide help in more effective dissemination of information, but that ultimately, the responsibility must rest in my own office. You may remember that this identifies closely with my own remarks during our previous meetings.

The Sea Grant publications people will meet in Madison, Wisconsin, on May 29 of this year to compare techniques and to formulate recommendations to my office for improving the system. It must be admitted that the system needs improving. I am still not satisfied with its effectiveness because all of the accomplishments that I have previously described are only as valuable as their utilization by those responsible for doing so.

And finally, our conclusion with respect to these accomplishments is that the Sea Grant concept works in practice as well as in theory, not only in its direct contribution to the localities being served, but in its national contribution, exactly as the Congress envisioned it. It took a half century for the Land Grant Program to demonstrate its worth, and only now, more than a century later, is the full, magnificent scope of its accomplishments really appreciated. It probably will not take as long for the rapidly accumulating results of the Sea Grant Program to prove its full value, but the program is really less than six years old in terms of time to achieve anything at all.

This point must be made: the problems and opportunities being tackled by the Sea Grant Program are difficult and complex, and the solutions are fraught with unknown pitfalls. If this were not the case, the problems would have been solved and the opportunities realized long ago. That so many questions have been answered in such a short time by Sea Grantees is a pleasant surprise, but does not disguise the fact that most solutions will take more time than has been available; Sea Grant is, in essence, a long-term program.

To be successful, long-term efforts must have continuity. A major key to Sea Grant success is that it has provided the resources that permit development, growth, and maintenance of teams and activities for sufficient time to achieve results. We intend to continue our support for on-going projects and to initiate support for new activities as they are justified.

This concludes my prepared testimony. I shall be glad to answer any questions.

Mr. ABEL. I am pleased to report at this time that all but eight of the coastal and Great Lakes States are now participating in the sea grant program.

As of the end of the last calendar year, the program now encompasses some 728 projects in nearly 150 universities and colleges, with almost an equal number of private companies, and an equal number of State and local agencies participating.

In other words, right at this moment there are something over 400 organizations taking part in the national sea grant program. Matching funds, from the required minimum of a third of the total cost of

the program, have risen to slightly over 40 percent on paper, and in actuality are approaching the 50 percent mark.

We are extremely proud of this; it indicates the interest and enthusiasm of State and local agencies, industries, and private foundations in our program. The network might possibly be growing somewhat faster, had we had the resources to support all the universities and industries that have applied for participation, but we are still quite optimistic at this time.

With our permission, I would like to cite a few examples of our activities, selected across the country, some of national interest, and some of local or regional interest.

For instance, the Massachusetts Institute of Technology has finished its environmental and economic study of the possible impact of a large scale oil find on Georges Bank. It excited quite a bit of interest, and I can furnish the highlights of their findings for the record.

Mississippi State University fabricated a remote underseas fisheries assessment system, RUFUS, and has lent it to the National Marine Fisheries Service to assess bottoms fishery resources in the Gulf of Mexico.

The sea mesh system developed at Washington, with the partial support from the University of Washington, looks like a real winner. It promises to reduce the time to clean a ship's hull on the average of something over 2 days to less than 2 hours, with consequent cost reduction, and—even more exciting—precluding the necessity for dry-docking.

The State University of New York is aiding agencies in power plant siting by providing information on the functioning of State agencies who are concerned in these activities, how power pricing policy affects economic growth in the State, the possible beneficial effects of thermal effluents, consideration of how one might make better recreational use of the buffer zones attendant upon power plants, and of course, measurements of the sizes of the effluents emanating from these plants.

The demand for the lawyers graduating from our University of Miami law program is increasing. They are now employed prominently throughout the country. They are now combining with the growing marine advisory service program in Miami to create a community legal problem service, which furnishes information respecting legal problems to State and local agencies.

The two-boat herring trawl developed at the University of Rhode Island, and offered to the Point Judith Fisherman's Cooperative was expanded to eight boats last year, which doubled the herring catch, and added \$200,000 to the value of their catch.

Our Texas A. & M. program has typically brought together engineers, technical specialists, and lawyers, to work on the beginning to end process for capturing fish, while protecting valuable shrimp resources, by conducting it from the original research and development concept through marketing.

As you know from previous testimony, we are very much interested in the possible utilization of presently underutilized species.

MIT is attempting to help the fishing community in the Northeast to quadruple the squid catch. This is part of the NOAA overall fisheries program in New England.

Under the stimulus of our grantees at the University of North Carolina, 50 eel fishermen have participated in a program aimed at under-utilized species. Their shipments of eel now exceed a half-million pounds annually.

A spinoff of this is that handicapped persons, through an organization for the blind, were taught to make the eel traps for sale to the fishermen.

Aquaculture remains our biggest program. It absorbs about 15 percent of our funds. Under the aegis of NOAA, some 500 scientists technicians across the country are conducting research on shrimp, salmon, lobster, seaweed, and so on.

I could easily utilize a couple of days to relate all the progress being made in this particular area, but I would like to highlight Dr. Lauren Donaldson, who has been working in this area long before sea grant, and who has developed what he likes to call Sea Grant Coho.

A return of one-half of 1 percent of hatchery salmon is considered quite good after 4 years at sea. Dr. Donaldson's Coho salmon returned in 2 years at a rate of 2.5 percent.

In our own office, Harold Goodwin is revising the sea grant long range plan first published about 4 years ago, under the aegis of the National Science Foundation.

The Marine Advisory Service referred to by Dr. White, under Howard Eckles' leadership, has blossomed into 28 programs in 22 States. In the last calendar year well over 50 major educational workshops were held for the improvement and edification of people who have to work in the sea. Over 5,000 persons attended these workshops.

The international study ordered by your subcommittee last year is proceeding well at the Massachusetts Institute of Technology under the leadership of Dr. Judith Kildow.

We have instituted a project to attempt to determine and identify those marine technologies which would be most likely to enhance this country's balance of trade position over the next 10 years.

A few moments ago, Mr. Mosher inquired concerning problem areas, and I would have to say that in all candor the area of gravest concern to me personally remains that of our delivery system. I cannot help but feel that, with all due respect to the finest products and services that any program can produce, none of them can achieve ultimate utility unless they can be conveyed usefully to all potential consumers.

We have instituted closer checks on the system to insure that reports of our various publications are more efficiently conveyed to all kinds of groups and individuals who can make best advantage of them.

I convened a meeting of all of the sea grant personnel assigned to this task last November in Delaware, and will do it again in Wisconsin this May.

My advisory panel's reaction to this is that our Marine Advisory Service can help in a way toward achieving this goal, but the ultimate responsibility still has to lie in my own office, and candor requires the admission I am still not satisfied.

A final point.

When first testifying on sea grant programs for this subcommittee, I originally projected first successes to be achieved perhaps in about 10 years. We have obviously achieved some successes at an earlier point. We have been lucky in some areas.

I would like to reiterate that where easy problems still might remain, you probably don't need a sea grant program. Success with respect to harder problems requires a long term effort, and this, of course, takes resources. This is one of our objectives, and hopefully we can stay at it for some time to come.

Thank you, sir.

Mr. DOWNING. Thank you.

In your prepared statement you indicated you wanted to submit some publications for the record.

Dr. ABEL. Yes, sir.

Mr. DOWNING. Do you have those available?

Dr. ABEL. Most of them, sir.

Mr. DOWNING. Without objection they will be admitted in the record at this point.

[The information referred to follows:]

**SUMMARY REPORT OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY
GEORGES BANK PETROLEUM STUDY**

NEW ENGLAND OFFSHORE OIL

Massachusetts Institute of Technology Sea Grantees recently completed a study regarding the potential economic and environmental effects of discovery and exploitation of large petroleum reserves to the New England region. Stimulus for the research was the potential presence of commercially valuable petroleum reserves in the Georges Bank area off Cape Cod. The study is significant in that it attacks a major regional problem from both the economic and environmental viewpoints simultaneously, using consistent hypotheses and assumptions.

Highlights of the economic findings include:

An oil find on Georges Bank, even a very large one, will not affect regional petroleum product prices.

The value of an oil find to the region depends on who receives the lease and royalty payments from developers—federal or states' governments'.

A deepwater crude oil terminal on the East Coast is, from a regional viewpoint, superior to the present shallow water terminals.

The environmental results the researchers found indicate:

A very large offshore find would roughly double the potential amount of oil spilled in New England waters, but this large find in itself would have little impact on the amount of oil spilled near shore.

The likelihood of a Georges Bank spill coming ashore is nil in winter and approximately five percent in summer.

A near shore spill appears substantially more damaging biologically than an offshore spill since almost all the oil's toxic effects will generally be confined to the first 24 to 48 hours.

The Sea Grant supported Georges Bank Petroleum Study has become the takeoff point for recent studies submitted by members of the MIT Offshore Oil Task Group to the Council on Environmental Quality. These studies include:

(a) "Analysis of Oil Spill Statistics"—J. W. Devanney; R. J. Stewart

(b) "Oil Spill Trajectory for the Atlantic Coast and Gulf of Alaska"—R. J. Stewart, J. W. Devanney, and W. Briggs

(c) "Simulation of Hypothetical Offshore Petroleum Development"—H. F. Lahman, J. B. Lassiter, and J. W. Devanney

SEA MESH HULL CLEANING SYSTEM: COST COMPARISON WITH OTHER HULL CLEANING SYSTEMS

[Actual area which will be cleaned by the Sea mesh system at the \$3,596.00 price is the area from the waterline to the turn of the bilge plus four feet past the turn of the bilge on the bottom of the ship: 675 times 32 equals 21,600 times 2 equals 43,200 plus 675 times 4 times 2 equals actual square footage which will be cleaned, 48,600]

	Shipyard A	Shipyard B	Scamp	Sequential sea mesh system
Drydock fee.....	\$10,466.28	\$11,734.92	None	None
Cleaning.....	4,860.00	4,860.00	\$3,626.00	\$3,596.00
Pilot fee.....	250.00	250.00	None	None
Downtime.....	7,000.00	7,000.00	3,500.00	145.00
Total.....	22,576.28	23,844.92	7,126.00	3,741.00

NOTES

Shipyard A equals sand blast cleaning method at 10 cents per square foot plus 33 cents per ton drydock fee.
 Shipyard B equals sand blast cleaning method at 10 cents per square foot plus 37 cents per ton drydock fee.
 Scamp equals underwater brushing method in Singapore, world's lowest hull cleaning price, \$3.29 per foot of length.
 Sea mesh equals underwater energy wave cleaning system.
 Area to be cleaned equals 48,600 square feet.
 Displacement tonnage equals 31,716 tons.
 Downtime rated at \$7,000 per day.

SHIP'S DATA

Owner, Kerr Steamship Company, Inc.
 Length, 675 feet; between perpendiculars, 630 feet.
 Draught, 32 feet.
 Displacement, 31,716 tons.
 Trial speed, 22.35 Knots.
 Propeller, 4 blade.
 Annual miles, 216,000.
 Miles per month, 18,000.

FUEL CONSUMPTION DATA

Fuel consumption rate, 100 tons per day.
 Tons of fuel per mile, .162 tons per mile.
 Cost of fuel, \$27 per ton.
 Miles per hour, 25.72 miles.
 Miles per day, (24 hours), 617.40 miles

SUMMARY REPORT ON THE UNIVERSITY OF MIAMI'S COMMUNITY LEGAL PROBLEM SERVICES

OCEAN LAW

The Ocean Law Program at the University of Miami contains both educational and research aims and each is designed to feed into the University's Advisory Services Program. The research phase of the program involves faculty as well as graduate students. In addition to identified research projects, a flexible, responsive system of filling requests for specific inquiries has been instituted through the Community Legal Problem Services (CLPS.)

The major objective of the CLPS is to provide the capability to respond to on-the-spot requests from the community having a need for legal research related to the oceans and the coastal zone.

A list of the University of Miami's response to requests is included.

CLPS (National) (R/L-1)

- | <i>Title of Report</i> | <i>Requesting Agency</i> |
|--|--------------------------|
| (1) May the U.S. Constitutionally Bind Itself to a Provisional International Regime? | Department of State. |
| (2) The Binding Effect of Executive Agreements under the U.S. Constitution. | Department of State. |

CLPS (National) (R/L-1)—Continued

<i>Title of Report</i>	<i>Requesting Agency</i>
(3) The Width of the Territorial Waters of the Bahama Islands Prior to Independence in July 1973.	James Ullman, Assistant U.S. Attorney, Miami.
(4) Is Information Submitted by the Coast Guard Required by the Motor Boat Safety Act of 1971, Privileged Information that May Not Be Divulged to the Public?	Capt. L. A. White, Office of Recreational Boating, 7th U.S. Coast Guard District, Miami.
Under preparation: What Is the Legal Status of the Joint International Deep Earth Sampling Project?	U.S. Executive Committee for JOIDES.

CLPS (State and local) (R/L-5)

<i>Title of Report</i>	<i>Requesting Agency</i>
(1) Who Governs Local Waters?-----	Task Force on Dade County Waterways Regulation.
(2) Municipal Powers under Florida Law with Respect to Protection of Environmentally Endangered Riparian Land.	City Attorney, North Miami.
(3) What Are Powers of Local Government Authorities under Florida Law to Dispose of Derelict and Abandoned Vessels Found in or Near Local Navigable Waters?	Richard Stone, Secretary of State, Florida.
(4) A Proposed Open Beaches Statute for Florida.	Coastal Zone and Wetlands Subcommittee of the Florida Environmental Land Management Study Commission.
(5) Appraisal of Aquatic Preserves in Florida---	Florida Coastal Coordinating Council
(6) A Guide for Florida Localities in Qualifying for National Flood Insurance Benefits.	Florida Coastal Coordinating Council.

U.S. DEPARTMENT OF COMMERCE,
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION,
Rockville, Md.

Reply to attention of: SG.

Date: November 29, 1973.

To: Sea Grant Program Directors.

From: Dr. Robert B. Abel, Director, National Sea Grant Program.

Subject: Publication of Sea Grant Results in Scientific Journals.

This memorandum refers to the *Sea Grant Program Description*, Part Three, Section 1.C. (p.30).

Many of the Sea Grant reports now issued by the various universities as special technical reports contain subject matter that is appropriate for publication in open scientific journals. Publication in the journals provides superior communication to the peers of the investigators. Special technical reports should be published only when it is not possible or practical for the material to appear in a scientific journal. An example of the latter case would be the instance in which the work had not proceeded to a point where it would be acceptable by the journals but had already produced information of use to people working in that field. A second instance might be a communication designed specially for specific sub-technical or non-technical audiences.

A number of quite lengthy Sea Grant reports have been published during the past few years. We recognize that in some instances the volume of material to be included in these reports exceeds the capabilities of most journals to publish in full. The need for such verbosity should always be examined. Sometimes, an additional abbreviated version suitable for journal publication might be a possibility.

This memorandum emphasizes our interest in maximum use of open journal publications for Sea Grant material. Further we would like to know what criteria are used by each institution in determining which reports are published in scientific journals versus special Sea Grant publications. Please provide us with this information at your convenience.

U.S. DEPARTMENT OF COMMERCE,
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION,
Rockville, Md.

Reply to attention of : SG.

Date: October 29, 1978.

Subject: Report of Conference with Sea Grant Publications Representatives.

To: Memorandum for the files.

On October 9, I attended a meeting at the University of Delaware sponsored by the Association of Sea Grant Program Institutions. During this meeting a special rump session was organized by Miss Linda Weimer (University of Wisconsin) and Mrs. Leatha Miloy (Texas A&M). The purpose of the session was to discuss the communications and publications aspects of the Sea Grant Program, with an eye to better coordination.

Representatives of nearly every university under Sea Grant institutional, college, or coherent project support were in attendance.

The publications people asked the following questions:

1. Can publications techniques among the universities under Sea Grant support be further standardized without destroying individual initiative?
2. Who, in the Sea Grant Office, has responsibility for publications and information dissemination, generally?
3. Who is responsible, in the Sea Grant Office, for coordinating public information?
4. To what extent does NOAA's Office of Public Affairs provide this sort of staff activity for Sea Grant?
5. What use is made of annual reports?
6. Who determines where the Sea Grant Office sends Sea Grant publications and what are the criteria for the determination?
7. While the individual Sea Grant Directors can deal comfortably with their local communities they would, naturally, have little access to similar communities around the country. How, therefore, could they be expected to know where the most likely consumers of their products and services would exist? Why could not the Sea Grant Office be more helpful in this regard?

These questions were, of course, cogent and critically important to administration of the National Sea Grant Program. I responded, therefore, that I was extremely sensitive to this problem because I felt, personally, that regardless of the merit and virtue of the Sea Grant products and services, their value would be limited only to the degree that they could be conveyed to the proper consumers. I stated, further, that I felt the Sea Grant delivery system to be the weakest component of the program and had so testified to NOAA, to the Commerce Department, and to the Congress on a great many occasions.

I further related my efforts to obtain permission to recruit a person or persons willing and competent to design, coordinate, execute, and control, the very best possible delivery system of which our program could be capable. Unfortunately, I could not report that my efforts were successful at this point.

The group's consensus was strongly in favor of greatly increased activity on this subject within the National Office. They decided to have a full scale meeting late next spring, and Linda Weimer offered the facilities of the University of Wisconsin for the purpose.

ROBERT B. ABEL,
Director, National Sea Grant Program.

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.. FROM RECORD IN THIS SEA GRANT PROJECT REPORT HAS THE FOLLOWING FORMAT ..

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..... STATE OR ORIGINATING AGENCY.....
..... INSTITUTION.....
..... CLASSIFICATION FILE.....
..... PROJECT TITLE.....
..... GRANT NUMBER.....
..... CODE/INIT DATE/SEA GRANT FUNDS/ MATCHING FUNDS.....
..... PRINCIPAL INVESTIGATOR.....

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EXPLANATION OF GRANT NUMBERS

DESCRIPTION	EXAMPLE	SOURCE
2 OR 3 DIGITS	114	GRANT AWARDED WHILE SEA GRANT WAS PART OF NATIONAL SCI. FOUNDATION
1 DIGIT FOLLOWED BY 5 DIGITS	9-16699	N.O.S.A. NUMBERING SYSTEMS
1 OR 2 DIGITS FOLLOWED BY 3 DIGITS	67 72	

THE FOLLOWING IS A LISTING OF THE 41 SEA GRANT CLASSIFICATIONS

CODE	CLASSIFICATION TITLE	CLASSIFICATION TITLE
41	AQUACULTURE - AQUACULTURE	POLLUTION - PESTICIDES
42	AQUACULTURE - FISH	POLLUTION - FORMAL AND RADIOACTIVE
43	AQUACULTURE - MOLLUSCS	POLLUTION - METALS
44	AQUACULTURE - OTHER ANIMALS	POLLUTION - OTHER
45	AQUACULTURE - PLANTS	RAIOMONITORIAL MODELS - PHYSICAL PROCESSES
46	COMMERCIAL FISHERIES - BIOLOGY	RAIOMONITORIAL MODELS - OTHER
47	COMMERCIAL FISHERIES - TECHNOLOGY	APPLIED CHEMICAL OCEANOGRAPHY
48	COMMERCIAL FISHERIES - ECONOMICS	APPLIED PHYSICAL OCEANOGRAPHY
49	COMMERCIAL FISHERIES - OTHER	COURSE DEVELOPMENT - CHEMICAL OCEANOGRAPHY
50	COASTAL ZONE MANAGEMENT	COURSE DEVELOPMENT - GEOLOGICAL OCEANOGRAPHY
51	COASTAL ZONE MANAGEMENT - FISHERIES	COURSE DEVELOPMENT - PHYSICAL OCEANOGRAPHY
52	COASTAL ZONE MANAGEMENT - OTHER	COURSE DEVELOPMENT - LAW
53	COASTAL ZONE MANAGEMENT - FISHERIES	COURSE DEVELOPMENT - BIOLOGY
54	COASTAL ZONE MANAGEMENT - OTHER	COURSE DEVELOPMENT - PATHOLOGY
55	COASTAL ZONE MANAGEMENT - FISHERIES	COURSE DEVELOPMENT - SEAFLOOR TECHNOLOGY
56	COASTAL ZONE MANAGEMENT - OTHER	COURSE DEVELOPMENT - FISHERIES
57	COASTAL ZONE MANAGEMENT - FISHERIES	COURSE DEVELOPMENT - AQUACULTURE
58	COASTAL ZONE MANAGEMENT - OTHER	COURSE DEVELOPMENT - OTHER
59	COASTAL ZONE MANAGEMENT - FISHERIES	COMMERCIAL DIVER TRAINING
60	COASTAL ZONE MANAGEMENT - OTHER	GEOMORPHOLOGICAL TECHNICIAN TRAINING
61	COASTAL ZONE MANAGEMENT - FISHERIES	AQUACULTURE TECHNICIAN TRAINING
62	COASTAL ZONE MANAGEMENT - OTHER	COMMERCIAL FISHERIES TRAINING
63	COASTAL ZONE MANAGEMENT - FISHERIES	TECHNICIAN TRAINING - OTHER
64	COASTAL ZONE MANAGEMENT - OTHER	ENGINEERING TRAINING
65	COASTAL ZONE MANAGEMENT - FISHERIES	TECHNICIAN TRAINING
66	COASTAL ZONE MANAGEMENT - OTHER	EDUCATION - OTHER
67	COASTAL ZONE MANAGEMENT - FISHERIES	EXTENSION AGENT SERVICES
68	COASTAL ZONE MANAGEMENT - OTHER	EXTENSION COURSE PROGRAMS
69	COASTAL ZONE MANAGEMENT - FISHERIES	EXTENSION PROGRAMS - OTHER
70	COASTAL ZONE MANAGEMENT - OTHER	CONFERENCES, INSTITUTES, ETC
71	COASTAL ZONE MANAGEMENT - FISHERIES	PUBLIC EDUCATION PROGRAMS
72	COASTAL ZONE MANAGEMENT - OTHER	PUBLICATIONS, AUDIO VISUALS, ETC.
73	COASTAL ZONE MANAGEMENT - FISHERIES	ADVISORY SERVICES - OTHER
74	COASTAL ZONE MANAGEMENT - OTHER	PROGRAM PLANNING
75	COASTAL ZONE MANAGEMENT - FISHERIES	PROGRAM ADMINISTRATION
76	COASTAL ZONE MANAGEMENT - OTHER	PROGRAM LOGISTIC SUPPORT
77	COASTAL ZONE MANAGEMENT - FISHERIES	NEW APPLICATIONS DEVELOPMENT
78	COASTAL ZONE MANAGEMENT - OTHER	
79	COASTAL ZONE MANAGEMENT - FISHERIES	
80	COASTAL ZONE MANAGEMENT - OTHER	
81	COASTAL ZONE MANAGEMENT - FISHERIES	
82	COASTAL ZONE MANAGEMENT - OTHER	
83	COASTAL ZONE MANAGEMENT - FISHERIES	
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97	COASTAL ZONE MANAGEMENT - FISHERIES	
98	COASTAL ZONE MANAGEMENT - OTHER	
99	COASTAL ZONE MANAGEMENT - FISHERIES	
100	COASTAL ZONE MANAGEMENT - OTHER	

** SEA GRANT PROJECT REPORT BY INSTITUTION **

UNIV. OF ALASKA	PROJECT DESCRIPTION	55	01 61	01,641	R M GOLDFERG 800
UNIV. OF ALASKA	COURSE DEVELOPMENT - LAW SCIENCE PROGRAM IN THE LAW OF THE SEA	55	01 61	01,641	R M GOLDFERG 800
UNIV. OF ALASKA	COURSE DEVELOPMENT - FISHERIES SCIENCE'S ACADEMIC PROGRAM	59	05/01/77	017,107	KRSTIC, J VAN MYNIG 017,600
UNIV. OF ALASKA	COURSE DEVELOPMENT - OCEAN ENGINEERING	61	01 61	500	T GARSTIENS 800
UNIV. OF ALASKA	COURSE DEVELOPMENT - OCEAN ENGINEERING ACADEMIC PROGRAM	61	05/01/77	500	T GARSTIENS 800
UNIV. OF ALASKA	COURSE DEVELOPMENT - OCEAN COASTAL PLANNING CAP ALASKA	62	01 61	900	LIOIA SELKOECH 07,100
UNIV. OF ALASKA	FFISSION COURSE PROGRAMS	72	05/01/77	044,616	T DOYLE 015,066
UNIV. OF ALASKA	ANVISORY SERVICES - OUMP SCIENTIFIC SUPPORT SERVICES OF THE UNIVERSITY OF ALASKA MUSEUM	77	05/01/77	011,904	L ROWINSKI 06,445
UNIV. OF ALASKA	PROGRAM ADMINISTRATION	79	05/01/77	025,022	DAVID MICKOK 061,000
UNIV. OF ALASKA	NEW APPLICATIONS DEVELOPMENT	81	01/01/77	06,000	R MICKOK 026,645

SEA GRANT PROJECT REPORT BY INSTITUTION **

CALIFORNIA

UNIVERSITY OF CALIFORNIA, DAVIS AQUACULTURE - COYSTERNS MARITIME FISH BREEDING OF COYSTERNS	01	06/01/72	03	03 26	000	ROBERT A. SIMESFR 000
CALIFORNIA STATE UNIV, HUMBOLDT AQUACULTURE - FISH SEMI-ARTIFICIAL REPRODUCTION OF SALMONID AND SALTRATED BROWN TROUT BREEDING SALMON AND TROUT	02	07/01/69	03 26	019,014	015,169	GEORGE M. ALLEN 015,169
CALIFORNIA STATE UNIV, HUMBOLDT AQUACULTURE - COYSTERNS & BENTHIC STUDY OF THE ANCHOR AGON AND LIPID NUTRITIONAL REQUIREMENTS OF THREE COMMERCIALY ...	03	07/01/69	03 26	013,570		WILLIAM V. ALLEN 013,570
CALIFORNIA STATE UNIV, HUMBOLDT COMMERCIAL FISHERIES - SALMON BIOLOGICAL INVESTIGATIONS OF THE CHENOOK SALMON AND OYSTER SALMON IN THE OCEAN OFF NORTHWEST CALIF	04	09/01/71	03 26	09,157		ROBERT VAN KIRK 09,157
CALIFORNIA STATE UNIV, HUMBOLDT COMMERCIAL FISHERIES - SALMON STUDIES ON THE ECOLOGY OF THE SEA ANCHOR, MALTDIE SUPPLEMENTS, IN NORTHWEST CALIFORNIA	06	12/01/73	03 26	021,039	00,307	JOHN D. DEMARTEL 00,307
CALIFORNIA STATE UNIV, HUMBOLDT POLLUTION - OTHER ISOLATION & STUDY OF MEGACODES WITH NEOPHYSE COMPLEX MOLECULES IN COAST PULP MILL EFFLUENTS	05	09/01/71	03 26	015,271	04,369	WILLIAM L. LESTER 04,369
CALIFORNIA STATE UNIV, HUMBOLDT EXTENSION AGENT SERVICES MARINE ADVISORY EXTENSION SERVICE	71	10/15/70	03 26	063,921		STANLEY A. LUMMIG 03,525
CALIFORNIA STATE UNIV, HUMBOLDT PROGRAM ADMINISTRATION PROGRAM ADMINISTRATION	79	09/01/72	03 26	07,070		RICHARD L. RIMMHOOR 05,630
CALIFORNIA INST OF TECHNOLOGY AQUACULTURE - PLANTS RESTORATION, PROPAGATION, AND MANAGEMENT OF MARINE ALGAE	05	05/01/69	03 26	0109,409		WHEELER J NORTH 070,000
UNIV OF CALIFORNIA, SD AQUACULTURE - COYSTERNS AQUACULTURE OF THE AMERICAN LOBSTER	01	07/01/71	03 26	0137,269		ROBERT SIMESFR 061,007
UNIV OF CALIFORNIA, SD AQUACULTURE - COYSTERNS AN AMERICAN LOBSTER FISHERY IN CALIFORNIA	01	07/01/69	03 26	063,500		F FORD 015,610
UNIV OF CALIFORNIA, SD AQUACULTURE - COYSTERNS CALIFORNIA SPRAY LOBSTER GRANT	01	07/01/69	03 26	05,200		D DEXTER 01,692

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SEA GRANT PROJECT REPORT BY INSTITUTION **

UNIVERSITY	PROJECT TITLE	DATE	AMOUNT	PI
CALIFORNIA				
UNIV OF CALIFORNIA, SD	POLLUTION - OCEAN	85	81 22	220,507
	MONITORING OF POLLUTION PARAMETERS IN S.F. BAY			
UNIV OF CALIFORNIA, SD	APPLIED PHYSICAL GEOGRAPHY	59	07/01/70	912,700
	PHYSICAL CRITICAL FOR RURAL PLANNING			
UNIV OF CALIFORNIA, SD	CHURCH DEVELOPMENT - OCEAN	67	07/01/68	66,000
	SEAFISH PRODUCTION IN APPLIED OCEAN SCIENCE			
UNIV OF CALIFORNIA, SD	MECHANISTIC TECHNOLOGY TRAINING	66	09/01/70	821,031
	UNDERGRADUATE TRAINING IN MARINE TECHNOLOGY			
UNIV OF CALIFORNIA, SD	SEA GRANT TRAINERS	70	07/01/68	873,000
	SEA GRANT TRAINERS			
UNIV OF CALIFORNIA, SD	EXTENSION AGENT SERVICES	71	03/01/77	901,014
	WATER EXTENSION SERVICE			
UNIV OF CALIFORNIA, SD	PUBLIC EDUCATION PROGRAMS	75	07/01/70	817,623
	OCEAN EDUCATION FOR THE PUBLIC			
UNIV OF CALIFORNIA, SD	PUBLICATIONS AND PUBLIC ADVISORY SERVICES	76	01 22	935,509
	PUBLICATIONS AND PUBLIC ADVISORY SERVICES			
UNIV OF CALIFORNIA, SD	ADVISORY SERVICES - OCEAN	77	01 22	916,700
	OCEAN ENGINEERING DATA CENTER			
UNIV OF CALIFORNIA, SD	PROGRAM ADMINISTRATION	79	07/01/70	8131,015
	MANAGEMENT AND PROGRAM DEVELOPMENT			
UNIV OF CALIFORNIA, SD	NEW APPLICATIONS DEVELOPMENT	81	07/01/71	811,525
	NEW PROJECTS			
CALIFORNIA STATE UNIV				
	OCEANIC TOUR MANAGEMENT SCIENCES AND ENGINEERING	79	07/01/70	9129,000
	ENVIRONMENTAL STUDIES & SERVICES FOR THE COMMUNITIES OF MONTEREY BAY REGION			

PAT WILDE 521,216
 DONALD S. IMMAN 916,400
 V ANDERSON 848,000
 GLENN A. FLITNER 819,166
 SHOR, WOLFE, SCHWITZOFF, WITZEL, ET AL 800
 WYMAN, W. CUMMINGS 862,102
 DONALD WILKIE 816,659
 GERALD WICK, 800
 J. M. JOHNSON 86,000
 G. SHOR 8102,511
 G. C. SHOR 800
 ROBERT E. ADAM 8112,515

INSTITUTION	PROJECT TITLE	DATE	AMOUNT	PI
SANTA BARBARA CITY COLLEGE	COMMERCIAL WASTE POLLUTION CONTROL TRAINING MONITOR	63 05/20/65	664,900	JIMMY BIRDS 816,960
UNIV SOUTHERN CALIFORNIA	ENVIRONMENTAL SCIENCES - AERIOLOGICAL ASPECTS OF THE AIRWAY OF THE ANCHOR, ENGINEER'S WORKSHOP, IN THE SAN-PEDRO-LONG BEACH WAREHOUSE	64 03 65	800	HASIL HERRKATITS 82,320
UNIV SOUTHERN CALIFORNIA	WATERWAYS AND CONTAMINANTS	26 03 65	630,330	J. J. LEE 816,860
UNIV SOUTHERN CALIFORNIA	COASTAL ENGINEERING	25 03 65	536,320	F. R. BOURCENAN 825,960
UNIV SOUTHERN CALIFORNIA	COASTAL ZONE MANAGEMENT AND ENVIRONMENTAL QUALITY OF SEMI-ENCLOSED COASTAL WATERS	74 03 65	546,200	D. WADEN 861,090
UNIV SOUTHERN CALIFORNIA	COASTAL ZONE MANAGEMENT AND ENVIRONMENTAL QUALITY OF SEMI-ENCLOSED COASTAL WATERS	74 03 65	546,200	J. FRIEDMAN & M. VAN ARSOON 87,270
UNIV SOUTHERN CALIFORNIA	COASTAL ZONE MANAGEMENT AND ENVIRONMENTAL QUALITY OF SEMI-ENCLOSED COASTAL WATERS	74 03 65	546,200	ROBERT WARRER 81,000
UNIV SOUTHERN CALIFORNIA	COASTAL ZONE MANAGEMENT AND ENVIRONMENTAL QUALITY OF SEMI-ENCLOSED COASTAL WATERS	74 03 65	546,200	D. F. SOULF 899,060
UNIV SOUTHERN CALIFORNIA	COASTAL ZONE MANAGEMENT AND ENVIRONMENTAL QUALITY OF SEMI-ENCLOSED COASTAL WATERS	74 03 65	546,200	RONALD J. REISH 84,320
UNIV-SOUTHERN CALIFORNIA	ECOSYSTEMS RESEARCH	69 07/31/71	84,690	MICHAEL C. ARNOIT 88,630
UNIV-SOUTHERN CALIFORNIA	ECOSYSTEMS RESEARCH	69 07/31/71	84,690	DAVID MARIE JUDE 89,130
UNIV SOUTHERN CALIFORNIA	POLLUTION - OCEAN	65 03 65	611,900	JOHN S. STREHMEN 87,200
UNIV SOUTHERN CALIFORNIA	POLLUTION - OCEAN	65 03 65	611,900	ROBERT R. GIVEN 87,060
UNIV SOUTHERN CALIFORNIA	POLLUTION - OCEAN	65 03 65	611,900	PETER J. FISCHER 850,200

** SEA GRANT PROJECT ORDER BY INSTITUTION **

			AC OF 06/10/71	PAGE
CALIFORNIA UNIV SOUTHERN CALIFORNIA FOUNDATION - OTHER GRADUATE PROGRAM IN MARINE AFFAIRS	70	01/01/71	810,503	ROSS CLAYTON 84,310
UNIV OF SOUTHERN CALIFORNIA FOUNDATION - OTHER LABORATORY-WORKS IN COASTAL ZONE PLANNING	70	07/01/71	817,903	MARGARETA MCCOY 85,800
UNIV SOUTHERN CALIFORNIA FOUNDATION - OTHER EDUCATION IN OCEAN & COASTAL ENGINEERING	70	01 65	81,903	JOHN LAUFFER 811,150
UNIV SOUTHERN CALIFORNIA ADVISORY SERVICES - OTHER MARINE ADVISORY PROGRAM	77	00/15/77	075,667	BYRON J. MATHOM 824,292
UNIV SOUTHERN CALIFORNIA PROGRAM ADMINISTRATION OCEAN RESOURCES DEVELOPMENT AND MANAGEMENT	70	07/01/70	841,673	EMILIN B. LINSKY 867,460

** SEA GRANT PROJECT REPORT BY INSTITUTION **

CONNECTICUT UNIV OF CONN POLLUTION - METALS DETERMINATION OF HEAVY METALS IN SHELFISH IN LONG ISLAND SOUND	43 62 66 06/01/72	915,759	S V CRMG 89,398
UNIV OF CONN POLLUTION - METALS HEAVY METAL WASTES IN LONG ISLAND SOUND - TRACE METAL SPECIATION	43 62 66 06/01/72	94,078	M F FITZGERALD 916,438
UNIV OF CONN POLLUTION - OTHER GENERAL OF WASTES IN LONG ISLAND SOUND	43 62 65 06/01/72	812,519	G F PASKAUSKY 85,045
UNIV OF CONN POLLUTION - OTHER WATER DISCHARGE INTO LONG ISLAND SOUND	43 62 65 06/01/72	86,475	R M ROBYNF 85,088
UNIV OF CONN POLLUTION - OTHER SUSPENDED MATERIAL TRANSPORT IN LONG ISLAND SOUND	43 62 65 06/01/72	919,585	M F ROULEM 86,268
UNIV OF CONN PROGRAM ADMINISTRATION PROJECT MANAGEMENT AND DEVELOPMENT	43 62 79 06/01/72	85,685	P DRULLINGE 911,135
UNIV OF CONN REGIONAL LOGISTIC SUPPORT BOAT OPERATIONS	43 62 68 06/01/72	59,213	G A CAMPBELL 87,635

DELAWARE ** SEA GRANT PROJECT REPORT BY INSTITUTION **

UNIV OF DELAWARE	PROJECT TITLE	PI	DATE	PI	PI	PI
UNIV OF DELAWARE	AQUACULTURE - MOLLUSKS	81	09/01/68	821,787	C. EPITAMIO	16,176
	SYSTEM ENGINEERING - DEVELOPMENT OF COMMERCIALLY VALUABLE MARINE SHELLFISH					
UNIV OF DELAWARE	AQUACULTURE - FISH ANIMALS	84	07/01/70	984	D. MAUER	12,500
	MARINE INVERTEBRATE RESOURCES					
UNIV OF DELAWARE	AQUACULTURE - FISH ANIMALS	85	07/01/71	583	D. MAUER	128,888
	DEMARITIMARIA DE SYSTEM INQUIRY IN DELAWARE 947- FEASIBILITY STUDY OF RAFT CULTURE OF OYSTERS 942					
UNIV OF DELAWARE	COMMERCIAL FISHERIES - BIOLOGY	84	01/19	191,504	V. LOSRICH	13,562
	NEW FISH SPECIES OF DELAWARE BAY					
UNIV OF DELAWARE	GEOLOGICAL GEOGRAPHY	89	09/01/78	111,774	B. F. THEODORAN	11,918
	SEISMIC DEFLECTION SURVEYS OF TERTIARY STRUCTURES OF DELAWARE BAY					
UNIV OF DELAWARE	MARINE ECONOMICS	16	12/24/71	923,224	D. J. AGNELLO	918,486
	ECONOMIC ANALYSIS OF COASTAL ZONE RELATED INDUSTRIES					
UNIV OF DELAWARE	SOCIO-POLITICAL STUDIES	79	07/01/78	323,147	D. A. DYNES	16,267
	SOCIOLOGICAL ASPECTS OF SEASIDE DEVELOPMENT					
UNIV OF DELAWARE	MATERIALS AND STRUCTURES	74	01/18	119,433	F. A. COSTELLO	11,642
	A STUDY OF LOCAL CORROSIVE FLOW NEAR THE BAY AND OFFSHORE FLOOD					
UNIV OF DELAWARE	ENGINEERING - AQUACULTURE	74	07/01/77	166,976	C. F. EPITAMIO	15,962
	ENGINEERING SUPPORT OF TERTIARIZATION PROJECTS - MARINE ENGINEERING					
UNIV OF DELAWARE	ENGINEERING - AQUACULTURE	74	09/01/68	115,161	F. COSTELLO	16,232
	SYSTEMS ENGINEERING OF SHELLFISH PRODUCTION					
UNIV OF DELAWARE	ENGINEERING - AQUACULTURE	74	07/01/77	115,646	B. DUMPOY	123,154
	ENGINEERING SUPPORT OF TERTIARIZATION PROJECTS - DEVELOPMENT OF MARINE TROPHIC FILTER					
UNIV OF DELAWARE	ENGINEERING - AQUACULTURE	74	01/18	155,625	C. EPITAMIO	19,785
	A DEMONSTRATION OF CLOSED CYCLE MARICULTURE					
UNIV OF DELAWARE	PORTS HARBORS AND OFFSHORE TECHNOLOGY	16	01/19	993	J. F. LYNCH	128,888
	A STUDY TO EVALUATE ALTERNATE OIL TRANSPORT SYSTEMS FOR DELAWARE					
UNIV OF DELAWARE	PORTS HARBORS AND OFFSHORE TECHNOLOGY	16	01/19	925,784	F. CAMFIELD	12,722
	PORT DEVELOPMENT AND MANAGEMENT					

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** SFA COUNT SUBJECT GROUP BY INDUSTRY **

DELEWARE
 DIV OF DELAWARE
 DIVISION OF REVENUE
 200 N. MARKET ST.
 WILMINGTON, DE 19801

INDIV OF DELAWARE
 DIVISION OF REVENUE
 200 N. MARKET ST.
 WILMINGTON, DE 19801

INDUSTRY	71	91	92
S M GUINN	977,457	911,100	922,614
V S CALIFED	467,067	911,100	949,614

.. SFA GRANT SUBJECT REPORT BY INSTITUTION ..

DISTRICT OF COLUMBIA

NATIONAL FISHERIES INST	01 25	LFE J WEDNIC
PRODUCTION - RIFMS	78 10/05/77	\$8,000
NATIONAL SCIENTISTS INSTITUTE SCHOLARSHIP/COMMITTEE PROGRAM		
WASHINGTON TECHNICAL INST.	2-15378	MARILENE S. MEERTMAN
OCEANOGRAPHIC TECHNICIAN TRAINING	66 02/01/77	\$10,000
IMPLEMENTATION OF THE MARINE SCIENCE TECHNOLOGY PROGRAM		

SEA GRANT PROJECT REVENUE BY INSTITUTION

INSTITUTION	PROJECT NUMBER	DATE	AMOUNT	PI	PROJECT TITLE
STATE UNIV SYSTEM OF FLORIDA					
ANACOSTIA - GUSTAFSON	01	03 63	\$16,488		SMFLOOD CONTROL
SELECTIVE BREEDING AND HYBRIDIZATION OF THE SHEEPSHEEP MACHOPACHUM					\$19,500
ACANTHOPUS AND M. PARCINUS					\$19,500
STATE UNIV SYSTEM OF FLORIDA					
ANACOSTIA - HOLMES	03	01/01/72	\$58,468		P. W. MCNEEL
SELECTIVE BREEDING + HYBRIDIZATION IN CLAMS + SYSTEMS					\$19,000
STATE UNIV SYSTEM OF FLORIDA					
ANACOSTIA - OTHER ANIMALS	04	03 63	\$23,000		CHARLES D. OHLSON
MATCHERY TECHNIQUES FOR THE COMMERCIAL CULTURE OF THE LUSWORN, APLICOLA CRISTATA, AS SOURCE OF MAT					\$12,700
STATE UNIV SYSTEM OF FLORIDA					
MATERIALS AND STRUCTURES	24	03 63	\$16,488		WM. W. MARTY
ENVIRONMENTAL GROUPING + CORROSION FATIGUE IN SEA WATER					\$11,500
STATE UNIV SYSTEM OF FLORIDA					
COASTAL ENGINEERING	25	03 63	\$19,189		D. J. + PFEFFER
WEARWEAR ATCULATION, LITTORAL PROFILE AND THE SAND BUDGET OF FLORIDA					\$59,500
STATE UNIV SYSTEM OF FLORIDA					
COMMERCIAL FISHERIES - TECHNOLOGY	39	03 63	\$19,993		F O DELAMATER + M COURTNEY
SCANNING ELECTRON MICROSCOPY OF LATERAL-LINE + OTHER SCALES OF FISHES, A PSEAL NEW TOOL IN FISHES MGT					\$12,700
STATE UNIV SYSTEM OF FLORIDA					
COMMERCIAL FISHERIES - TECHNOLOGY	39	03 63	\$9,489		S A CHRISTENSEN
HYDRODYNAMIC MODEL AND MONITORING EVALUATION OF NETS AND TRAWLS					\$5,700
STATE UNIV SYSTEM OF FLORIDA					
SEAFORD SCIENCES AND TECHNOLOGY	35	03 63	\$19,194		P A DENNISON
THE LIPID COMPOSITION OF MULLET + METHODS FOR CONTROLLING THE OXIDATIVE DEGRADATION CAUSING RANCIDITY					\$11,600
STATE UNIV SYSTEM OF FLORIDA					
ECOSYSTEMS RESEARCH	69	03 63	\$19,830		T. S. HOPKINS
INTERRELATIONSHIPS OF BIOLOGY, CHEMISTRY + GEOLOGY OF ESCAMBARIA MAR + ADJACENT WATERS					\$62,000
STATE UNIV SYSTEM OF FLORIDA					
POLLUTION - PESTICIDES	62	03 63	\$58,483		ROBERT J. LIVINGSTON
CHRONIC EFFECTS OF CERTAIN CHLORINATION HYDROCARBON INSECTICIDES ON PSYCHOLOGICAL BEHAVIOR OF GULF STRIPED BAIT					\$24,700
STATE UNIV SYSTEM OF FLORIDA					
ENVIRONMENTAL MODELS - OTHER	69	03 63	\$23,299		HOWARD F. ODOM
SIMULATION OF MACROMODELS IN BEN COASTAL PLANNING					\$18,700
STATE UNIVERSITY SYSTEM OF FLORIDA					
EDUCATION - OTHER	70	03/01/72	\$00		ROBERT E. SMITH
SCIENTIST-IN-RESIDENCE TRAINING PROGRAM					\$00
STATE UNIV SYSTEM OF FLORIDA					
ADVISORY SERVICES - OTHER	77	03 63	\$19,189		JOE N. RUSBY
MARINE ADVISORY PROGRAM					\$79,000

FLORIDA SEA GRANT PROJECT REPORT BY INSTITUTION 00

UNIVERSITY	PROJECT TITLE	PI	DATE	AMOUNT	PI NAME
STATE UNIV SYSTEM OF FLORIDA	SEA GRANT ADMINISTRATION	79	01/01/77	965,500	M L BOWEN
STATE UNIV SYSTEM OF FLORIDA	ADMINISTRATION OF THE STATE UNIV SYSTEM OF FLORIDA SEA GRANT PROGRAM				326,300
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	01	03/27	995,000	F WILLIAMS
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				322,800
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	01	03/27	989	J W FELL
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				327,362
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	01	03/27	989	MARTIN
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				316,666
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	01	03/27	910,000	WON TACK YANG
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				316,666
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	06	07/01/71	946,864	F D MOORE
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				300
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	08	03/27	989	C S IVERSEN
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				320,091
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	04	07/01/71	911,000	M M SIGEL
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				96,859
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	17	07/01/71	921,500	M M SIGEL
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				321,927
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	16	07/01/71	929,329	L C ANDERSON
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				33,227
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	15	07/01/71	915,725	R M OGDONOR
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				87,104
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	17	07/01/71	915,330	T A OLINGHAM, JR
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				95,614
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	26	07/01/71	94,000	K C COMPTON
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				325,988
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	39	07/01/72	935,000	S C RAUBIN + C F PRILLIANT
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				326,466
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS	48	07/01/72	914,650	A THORVAUG
UNIV OF MIAMI	EDUCATION - CONSTITUTIONS				327,599

** SEA GRANT PROJECT REPORT BY INSTITUTION **

UNIVERSITY	PROJECT TITLE	PI	DATE	AMOUNT	PI NAME
FLORIDA	UNIV.-OF-MIAMI				
	ECOSYSTEMS RESEARCH				
	APPLIED ECOLOGY (4) - A FIELD STUDY OF COASTAL VEGETATION	68	07/01/71	900	J M GARRETT \$11,016
	POLLUTION - OTHER				
	UNIV.-OF-MIAMI				
	APPLIED ECOLOGY (4) - BIOLOGICAL INTERACTIONS / MACROBIOLOGICAL HAZARDS	65	01/27	920,000	M SALLMAN \$12,061
	ENVIRONMENTAL MODELS - PHYSICAL PROCESSES	66	07/01/69	920,000	T M LEE \$29,540
	APPLIED ECOLOGY (2) - CIRCULATION AND EXCHANGE PROCESSES	67	01/27	900	J M GARRETT \$15,496
	UNIV.-OF-MIAMI				
	ENVIRONMENTAL MODELS - BIOLOGICAL PROCESSES	67	01/27	900	J M GARRETT \$15,496
	APPLIED ECOLOGY (1) - EFFECTS OF MICROBIOLOGICAL COMPOUNDS ON FLOTTANTS	68	07/01/71	900	R M OGDON \$53,024
	UNIV.-OF-MIAMI				
	COURSE DEVELOPMENT - LAW	69	07/01/71	900	RICHARD G RANCO 900
	UNIV.-OF-MIAMI				
	PUBLICATIONS, AUDIO VISUALS, ETC.	70	07/01/69	955,000	G L VOSS \$12,050
	INFORMATION DISSEMINATION				
	UNIV.-OF-MIAMI				
	PUBLICATIONS, AUDIO VISUALS, ETC.	71	07/01/71	915,000	M SALLMAN \$25,076
	MANUALS ON MARINE ORGANISMS				
	UNIV.-OF-MIAMI				
	ADVISORY SERVICES - OTHER	72	01/27	970,000	R M OGDON \$6,607
	MARINE BIOLOGICAL SERVICES				
	UNIV.-OF-MIAMI				
	ADVISORY SERVICES - OTHER	73	07/01/71	910,000	R M OGDON \$6,607
	COASTAL ZONE WORKSHOP				
	UNIV.-OF-MIAMI				
	PROGRAM PLANNING	74	07/01/69	920,000	R M OGDON \$106,590
	PROGRAM MANAGEMENT AND DEVELOPMENT				
	UNIVERSITY OF SOUTH FLORIDA				
	POLLUTION - RESOURCES	62	02/15/71	900	CLINTON J. DAMS 900
	ECOLOGICAL AND CULTURAL STUDIES IN THE BAY ALGA FUCHSINA INTERVIEW				

SEA GRANT PROJECT REPORT BY INSTITUTION **

INSTITUTION	PROJECT TITLE	PI	START DATE	END DATE	AMOUNT	PI NAME
LOUISIANA	LOUISIANA STATE UNIV AQUACULTURE - CRUSTACEANS CALAPISH CULTURE	01	07 19		84,636	J W AVAULT, JR 815,210
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV AQUACULTURE - CRUSTACEANS NUTRITION OF MARINE SHELL AND INVERTEBRATE MOLLUSCS DEVELOPMENT	01	07 19		84,394	S P MEYERS 68,974
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV AQUACULTURE - FISH CULTURE OF FISH IN PONDS, BAYWAYS, AND LAKES	02	07 19		84,636	J W AVAULT 815,669
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV AQUACULTURE - OTHER ANIMALS ANNUCULTURAL AND RESOURCE UTILIZATION STUDIES IN FISHING CANALS	04	07 19		84,642	A MORRIS 821,744
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV BIOLOGICAL OCEANOGRAPHY MIGRATION AND DISTRIBUTION OF BENTHIC RESOURCES	07	07 19		957,471	F W PRUESSE 955,515
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV PATHOLOGY OF MARINE ORGANISMS INFECTIOUS OF THE BLUE CRAB WITH -LEPTOHEILACUS STANUS- IN A DIFFERENT SALINITY ENVIRON OF SF LA)	04	07 19		89,986	J C RAGAN 87,946
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV MARINE ECONOMICS ECONOMIC STUDY OF LOUISIANA COASTAL RESOURCES	14	07 19		813,626	D B JOHNSON 811,213
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV OCEAN LAW - COASTAL PLANNING AND MANAGEMENT IN LOUISIANA'S COASTAL ZONE	15	07 19		817,962	M J WASHMAN 816,230
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV OCEAN LAW - INTERNATIONAL LEGAL ASPECTS OF OCEAN RESOURCES EXPLOITATION	16	07 19		811,394	M C KNIGHT 815,665
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV SOCIO-POLITICAL STUDIES HUMAN FACTORS IN WETLAND RESOURCES DEVELOPMENT	20	07 19		815,889	A L BERTRAND 815,663
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV SOCIO-POLITICAL STUDIES URBAN ENCROACHMENT IN THE NEW ORLEANS AREA	29	07 19		85,660	S M GAGLIANO 81,759
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV SEAFOOD SCIENCE AND TECHNOLOGY DEVELOPMENT OF GULF FISHERIES PRODUCTS	35	07 19		831,727	A F NOVAK 819,736
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV PORTS HARBORS AND OFFSHORE TERMINALS LOUISIANA SIMULATED FEASIBILITY STUDIES	36	07 19		815,886	J M STONE 821,660
LOUISIANA STATE UNIV	LOUISIANA STATE UNIV COASTAL ZONE MANAGEMENT-SCIENCE AND ENGINEERING ENVIRONMENTAL ANALYSIS FOR COASTAL ZONE PLANNING	39	07 19		816,775	S GAGLIANO 819,639

00 SPA GRANT PROJECT REPORT BY INSTITUTION 00

INSTITUTION	PROJECT TITLE	START DATE	END DATE	AMOUNT	PI
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	S P METZKE 910,378
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	J G CASSELLINE 916,591
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	E C GERRILL 916,661
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	M R ZANON M PIKE 916,617
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	M G SWITH J M OBY 916,621
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	M WILKINS JR M M PIKE 916,636
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	G A WITTEWORTH 916,666
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	J R VAN LOPTEK 916,767
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	L L BESSON 919,720
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	E E BECKER 919,876
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	I R EDDY 919,889
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	M J WERSHMAN 919,866
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	E C HOVAK M M GROOME 927,210
LOUISIANA STATE UNIV	ECOSYSTEMS RESEARCH	07/19/69	07/19/70	957,976	J R VAN LOPTEK 958,377

AS OF 06/30/73 PAGE 23

** CFA GRANT REPORT BY INSTITUTION **

LOUISIANA
LOUISIANA STATE UNIV
PROGRAM LOGISTIC SUPPORT
FIELD LOGISTIC SUPPORT

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817.205

01 19
08/01/68 976.209

** SFA GRANT PROJECT REPORT BY INSTITUTION **

INSTITUTION	PROJECT TITLE	REPORT NO.	DATE	AMOUNT	REPORTER	
UNIV OF MAINE EXTENSION PROGRAMS - DIMER COMMERCIAL IMPLEMENTATION OF AQUICULTURE IN MAINE		73	03 63 05/31/71	916,754	P. D. RING 94,867	
	UNIV OF MAINE PUBLIC EDUCATION PROGRAMS MAINE ADVISORY SERVICES- PUBLIC EDUCATION		75	03 63 11/31/72	918,105	PAUL D RING 948
			76	03 63 11/31/72	911,359	PAUL D RING 900
			79	03 63 05/31/71	913,101	DAVID DEAN 95,192
UNIV OF MAINE PROGRAM ADMINISTRATION SFA GRANT PROGRAM ADMINISTRATION		81	03 63 05/31/71	96,221	DAVID DEAN 95,392	
	SOUTHERN MAINE VOCATIONAL TECHNICAL INST. OCEANOGRAPHIC TECHNICIAN TRAINING APPLIED MARINE BIOLOGY & OCEANOGRAPHY	66	2-35154 07/31/72	900	TAPAN BANERJEE 900	
MAINE DEPT. OF SFA & SHORF FISHERIES EXTENSION AGENT SERVICES		71	1972 03/31/70	975,909	PAUL M.H. VERMO 917,580	
		71	03 63 05/31/71	96,221	DAVID DEAN 95,392	

.. SEA GRANT PROJECT REPORT BY INSTITUTION ..

MARYLAND
 UNIV OF MARYLAND
 PATHOLOGY OF MARINE ORGANISMS 03 07 0 P COLWELL
 VIRUS PATHOGENICITY AND RELATED ORGANISMS IN CHEESAPEAKE BAY-ISOLATION, PATHOGENICITY AND ECOLOGY 03 06/06/76 \$116,103 \$53,215
 UNIV. OF MARYLAND
 OCEAN ENGINEERING - OTHER 24 06/15/63 \$67,702 \$16,365
 HIGH-EFFICIENCY CONVECTIVE HEAT TRANSFER SYSTEM FOR DEEP SUBMERGENCE AND REMOTE APPLICATION 69
 UNIVERSITY OF MARYLAND
 COMMERCIAL FISHERIES - TECHNOLOGY 18 06/10/77 \$17,003 \$14,588
 STUDIES IN IMPROVE SOFT-SHELL CLAM QUALITY

MASSACHUSETTS

BOSTON UNIVERSITY COMMERCE, INDUSTRIES, ETC MARINE FIBERS CONFERENCE	74	02/15/72	74	913,675	GEORGE P. FULFON \$7,000
MASS INST OF TECH AQUACULTURE - OTHER AQUACULTURE AQUACULTURE SUBJECT DEVELOPMENT	64	07/01/72	64	97,254	M W SEIFERT \$1,000
MASS INST OF TECH BIOLOGICAL OCEANOGRAPHY PLANNING THE DEVELOPMENT OF AUTOMATIC MEANS OF CLASSIFYING PLANKTON	67	07/01/72	67	915,191	LOUIS SUZRO \$3,100
MASS INST OF TECH MINERAL RESOURCES - OTHER ASSEY OF THE MARINE RESOURCES OF MASSACHUSETTS BAY	61	07/01/72	61	921,009	J R CASSETER \$13,000
MASS INST OF TECH MINERAL RESOURCES - OTHER OFFSHORE PETROLEUM AND NEW ENGLAND	10	07/22/72	10	973,209	J W DEWANNEY + J R CASSETER \$12,019
MASS INST OF TECH SOCIO-POLITICAL STUDIES NON-TECHNICAL PROBLEMS OF MARINE WASTE-FOOD RECYCLING SYSTEMS	29	07/01/72	29	916,099	T RYED + JOHN MCGUENIN \$14,896
MASS INST OF TECH MATERIALS AND STRUCTURES FRACTURE TOUGHNESS OF OBTAINED POLYESTER MULL MATERIALS	24	07/01/72	24	923,004	F J MCGARRY \$11,000
MASS INST OF TECH OCEAN ENGINEERING - OTHER WASTE WATER TREATMENT WITH HIGH ENERGY ELECTRODES	24	07/01/72	24	924,500	JOHN C TRUMP \$5,000
MASS INST OF TECH OCEAN ENGINEERING - OTHER FUNDAMENTAL RESEARCH AND UNDERWATER WELDING AND CUTTING	28	07/01/72	28	919,050	K. MASBUCHT \$6,018
MASS INST OF TECH SEAFORD SCIENCE AND TECHNOLOGY UTILIZATION OF SAUID FOR PROCESSED FOOD PRODUCTS	35	07/01/72	35	939,750	S A COLOMBITH \$15,100
MASS INST-OC TECH PLOTS HARBORS AND OFFSHORE TERMINALS ENVIRONMENTAL IMPACT OF A SUPERPORT IN THE MACHIAS BAY AREA	36	06/01/72	36	929,900	STEPHEN F MOORE \$00
MASS INST OF TECH PLOTS HARBORS AND OFFSHORE TERMINALS PORT DESIGN AND ANALYSIS METHODOLOGY	36	07/01/72	36	929,074	F.G.FRANCKL \$10,619
MASS INST OF TECH TRANSPORTATION SYSTEMS - OTHERS OCEAN-BOUND COMMERCE AND THE FUTURE OF THE INTEROCEANIC CANAL	37	07/01/72	37	924,600	M. J. BARILEPPO \$10,600

SEA GRANT PROJECT REPORT BY INSTITUTION **

MASSACHUSETTS
 MASS-INST OF TECH
 ENVIRONMENTAL MODELS - PHYSICAL PROCESSES
 THE SEA ENVIRONMENT IN MASSACHUSETTS BAY AND ADJACENT WATERS
 65 07/01/77 \$16,050
 A. L. EPDM & E. L. MOLLO-CHRISTENSEN
 \$84,136

MASS-INST OF TECH
 COURSE DEVELOPMENT - OCEAN ENGINEERING
 STUDENT SUMMER LABORATORY
 61 07/01/78 \$24,721
 A. D. GABMICHAEL
 \$14,548

MASS-INST OF TECH
 TECHNICIAN TRAINING - OIMR
 OCEAN ENGINEERING UNDER IETV
 67 07/01/77 \$16,741
 A. D. GABMICHAEL
 \$5,168

MASS-INST OF TECH
 EDUCATION - OIMR
 INTERDISCIPLINARY SYSTEMS DESIGN SUBJECT
 70 06/01/78 \$14,988
 M. W. SCIFERT
 \$16,077

MASS-INST OF TECH
 EXTENSION AGENT SERVICES
 ADVISORY SERVICES, DEVELOPMENT, OPERATION AND MANAGEMENT
 71 07/01/77 \$29,981
 I. DYER & R. A. MOHM
 \$22,528

MASS-INST OF TECH
 CONFERENCE, INSITUITS, ETC
 SYMPOSA ON SEA GRANT PROJECTS AND MARINE RESOURCES RELATED TOPIC
 74 07/01/71 \$9,270
 R. A. MOHM
 \$11,780

MASS-INST OF TECH
 PUBLIC EDUCATION AND TRAINING SHORT COURSES
 75 07/01/71 \$83
 J. M. AUSTIN
 \$14,787

MASS-INST OF TECH
 PUBLICATIONS, AUDIO VISUALS, ETC.
 SEA GRANT RELATED REPORTS AND INFORMATION
 76 07/01/71 \$7,720
 IPA DYER & DEAN MOHM
 \$5,288

MASS-INST OF TECH
 ADVISORY SERVICES - OIMR
 STATE TASK FORCE SUPPORT
 77 07/01/77 \$83
 M W SCIFERT
 \$5,129

MASS-INST OF TECH
 ADVISORY SERVICES - OIMR
 MARINE EXTENSIVE INFORMATION CENTER
 77 06/01/78 \$67,128
 M. JONES
 \$16,890

MASS-INST OF TECH
 WPA APPLICATIONS DEVELOPMENT
 SEA GRANT PROGRAM MANAGEMENT
 81 06/01/78 \$64,681
 I M KEIL & I DYER
 \$80,705

WOODS HOLE OCEANOGRAPHIC INST
 AQUACULTURE - MOLLUSK
 COLLAB SOUND MOTION PICTURE FILM DOCUMENTARY ON REPRODUCTION OF THE OYSTER BY THE OYSTER WORM
 83 07/01/77 \$3,591
 W R GAMMETER
 \$1,759

WOODS HOLE OCEANOGRAPHIC INST
 COMMERCIAL FISHERIES - BIOLOGY
 TAGGING & RELATED STUDIES OF CERTAIN LARGE PELAGIC FISHES IN THE WESTERN NORTH ATLANTIC
 96 07/01/77 \$17,269
 FRANK J WATNER, III
 \$4,519

•• SCA GRANT SUBJECT ORDER BY INSTITUTION ••

MASSACHUSETTS
 WOODS HOLE OCEANOGRAPHIC INST.
 ENGINEERING - AQUACULTURE
 DESIGN, CONSTRUCTION & OPERATION OF A CONTINUED SPARG
 TREATMENT & AQUACULTURE SYSTEM
 25 02/01/72 955,800 JOHN H. WYMER
 827,500

Woods Hole Oceanographic Institution
 MARINE SCIENCE
 STUDY OF CHEMICAL COMMUNICATION BY MARINE ANIMALS
 29 01/01/72 900 JEFF AITMA
 100

Woods Hole Oceanographic Inst
 COURSE DEVELOPMENT - OCEAN ENGINEERING
 OCEANOGRAPHIC ENGINEERING SCIENTIFIC DEVELOPMENT
 61 08/01/71 669,200 J. W. HAYDEN, JR.
 996,692

UNIVERSITY	PROJECT TITLE	PI	START DATE	END DATE	AMOUNT
MICHIGAN	UNIV OF MICHIGAN ECOSYSTEMS APPROACH WATER CIRCULATION	DR. F. C. WOODMAN	03 23	07/01/70	553,050
	UNIV OF MICHIGAN ECOSYSTEMS APPROACH WATERBORN LAND USE	DR. K. POLAKOWSKI	03 23	07/01/69	325,055
	UNIV OF MICHIGAN ECOSYSTEMS APPROACH ENVIRONMENTAL DYNAMICS	DR. F. C. WOODMAN	03 25	07/01/69	321,697
	UNIV OF MICHIGAN POLLUTION - OTHER WATER QUALITY INVESTIGATION	J J GANNON	03 25	07/01/69	320,097
	UNIV OF MICHIGAN POLLUTION - OTHER WASTEWATER TREATMENT ALTERNATIVES	M J HENGE, JR	03 23	01/01/71	320,012
	UNIV OF MICHIGAN ENVIRONMENTAL MODELS - PHYSICAL PROCESSES HYDROLOGY & SEDIMENT PROSION	DR. F. F. BRATER	03 23	07/01/70	320,051
	UNIV OF MICHIGAN ENVIRONMENTAL MODELS - PHYSICAL PROCESSES IMPACT ON LAKES & RIVERS OF SEPARATE FROM POLLUTED GROUNDWATER	F F BRATER	03 23	07/01/70	320,076
	UNIV OF MICHIGAN ENVIRONMENTAL MODELS - PHYSICAL PROCESSES WATER CIRCULATION MODELS FOR GREAT TRAVELERS RAY	DR. A. W. GREEN JR.	03 23	07/01/71	320,000
	UNIV OF MICHIGAN ENVIRONMENTAL MODELS - MATHEMATICAL PROCESSES STOCHASTIC MODELING	F D ROTMAN	03 23	07/01/71	320,000
	UNIV OF MICHIGAN ENVIRONMENTAL MODELS - MATHEMATICAL PROCESSES MATHEMATICAL MODELING OF BIOLOGICAL PRODUCTION	R P GAMBLE	03 23	07/01/70	320,000
	UNIV OF MICHIGAN ENVIRONMENTAL MODELS - OTHER RESOURCE-SYSTEM MODELING	DR. R. L. PATTER	03 23	07/01/70	320,000
	UNIV OF MICHIGAN ENVIRONMENTAL MODELS - OTHER INTERACTIVE DISPLAY OF WATER RESOURCES DATA - U OF M	DR. R. L. PHILLIPS	03 23	07/01/70	320,000
	UNIV OF MICHIGAN GRASS DEVELOPMENT - RIZLOGY EDUCATION & TRAINING	DR. J. W. ARMSTRONG	03 23	07/01/69	320,000
	UNIV OF MICHIGAN EXTENSION AGENT SERVICES ADVISORY SERVICES	DR. STEPHEN SCHMEIDER	03 23	07/01/69	320,000

MISSISSIPPI STATE UNIVERSITY

PROJECT DESCRIPTION	DATE	AMOUNT	PI	PI ADDRESS
MISSISSIPPI STATE UNIVERSITY EDUCATION - AGRICULTURE IN MARINE ENGINEERING TECHNOLOGY	78 09/1/74	900	110	J.E. THOMAS 800
UNIV MARINE CENTER - MISS BRUNO LUMME - PLANTS SELECTIVE ALGAL FERTILIZATION BY AQUATIC ANGIOSPERMS	85 11/21/71	510,000	83 53	GEORGE DESSONOFF 95,500
UNIV MARINE CENTER - MISS BIOLOGY OF MARINE ORGANISMS POSSIBILITIES OF MARINE ANIMALS IN THE SOUTHERN GULF OF MEXICO	84 03 53	510,250	83 53	JOHN OVERSTREET 325,750
UNIV MARINE CENTER - MISS OCEAN LAW - COASTAL LEGAL PROBLEMS OF THE GULF COAST REGION	85 06/21/72	925,500	83 53	FRANK MARAST 813,050
UNIV MARINE CENTER - MISS RECREATION - SPORTS FISHERIES MAGNETIC AND SONAR FISHING IN GULF OF MEXICO	84 06/21/71	510,000	83 53	T MCILWAIN 94,205
UNIV MARINE CENTER - MISS VEHICLES, VESSELS, AND AIRBORNE UNMANNED RECONNAISSANCE VEHICLE DESIGN	84 06/21/71	515,450	83 53	J F THOMAS & R MENTON 800
UNIV MARINE CENTER - MISS COASTAL ZONE MANAGEMENT SOCIAL SCIENCES AN ANALYSIS OF ECONOMIC COMPOSITION & GROWTH COMPONENTS OF THE COASTAL ZONE OF MISSISSIPPI	84 03 53	510,000	83 53	J BUDDUS 94,600
UNIV MARINE CENTER - MISS COASTAL ZONE MANAGEMENT SOCIAL SCIENCES COASTAL ZONE MANAGEMENT	85 11/21/71	510,000	83 53	R C WILLIAMS 93,737
UNIV MARINE CENTER - MISS ECOSYSTEMS APPROACH THE DETERMINATION OF ECOLOGICAL ALTERATIONS CAUSED BY POLLUTANTS	89 06/21/71	537,605	83 53	LEWIS BRUMM 510,117
UNIV MARINE CENTER - MISS APPLIED PHYSICAL OCEANOGRAPHY THE CURRENT REGIME AND EXCHANGE CHARACTERISTICS OF A BAY DISCHARGE INTO MISSISSIPPI SOUND	89 03 53	510,000	83 53	CHARLES TELEUTERUS 320,000
UNIV MARINE CENTER - MISS COASTAL DEVELOPMENT - LAW INTERNATIONAL BAY STIMULI IN EXAMPLES OF THE COASTAL ZONE	85 11/21/71	510,000	83 53	MARAST / GOROVE 800
UNIV MARINE CENTER - MISS COASTAL DEVELOPMENT - LAW MARINE L AND SCIENCES	85 11/21/71	510,000	83 53	MARAST / GOROVE 800
UNIV MARINE CENTER - MISS COASTAL DEVELOPMENT - LAW LAW OF THE COASTAL ZONE	85 11/21/71	510,000	83 53	MARAST / GOROVE 52,250

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** IFA GRANT SUBJECT OFFICE BY INSTITUTION **

INSTITUTION	OFFICE	BY	INSTITUTION	AMOUNT	DATE
UNIV MARIAN CENTER - MISS	62	01 51	J C THOMAS	988	
CHURCH DEVELOPMENT - MISS					
DEVELOPMENT OF AN ECONOMIC INSTITUTIONAL COURSE					
UNIV MARIAN CENTER - MISS	71	11/19/71	LEON PAULSTIC	917,009	
TELEVISION FOR SERVICE					
MAJOR PRESENTATION SERVICES					
UNIV MARIAN CENTER - MISS	75	11/19/71	L PAULSTIC	92,749	
PUBLIC RELATION SERVICE					
MAJOR PRESENTATION SERVICES					
UNIV MARIAN CENTER - MISS	76	11/19/71	L PAULSTIC	659	
PUBLICITY, AUDIO VISUALS, REC.					
MAJOR COMMUNICATIONS - INFORMATION INSTITUTION AND SERVICE					
UNIV MARIAN CENTER - MISS	77	04/19/71	SIDNEY D UPHAM	92,326	
PERSONAL COMMUNICATIONS					
MAJOR PRESENTATION AND SERVICE					

NEW MEMBERSHIP

UNIT	MEMBER NAME	DATE	AMOUNT	REMARKS
01	R A MILLER	07/30/77	\$1,500	
02	W STEWART	03/30/77	\$15,100	
03	P J SAWYER	03/30/77	\$1,500	
04	A C MATTHEWS	03/30/77	\$9,500	
05	M W SKUIT	03/30/77	\$1,500	
06	BARBARA COLLIER	03/30/77	\$1,500	
07	GLEN C GERMAN	03/30/77	\$1,500	
08	T C LINDER & F ANDERSON	03/30/77	\$15,100	
09	ANDREW H SAVAGE	03/30/77	\$1,500	
10	J B WURDOCH	03/30/77	\$17,500	
11	R A MILLER	03/30/77	\$99,500	
12	G M SAVAGE	03/30/77	\$15,000	

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NEW MEMBERSHIP

UNIT 01 - NEW MEMBERSHIP

UNIT 02 - NEW MEMBERSHIP

UNIT 03 - NEW MEMBERSHIP

UNIT 04 - NEW MEMBERSHIP

UNIT 05 - NEW MEMBERSHIP

UNIT 06 - NEW MEMBERSHIP

UNIT 07 - NEW MEMBERSHIP

UNIT 08 - NEW MEMBERSHIP

UNIT 09 - NEW MEMBERSHIP

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UNIT 39 - NEW MEMBERSHIP

UNIT 40 - NEW MEMBERSHIP

UNIT 41 - NEW MEMBERSHIP

UNIT 42 - NEW MEMBERSHIP

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.. TRA COUNT SUBJECT REPORT BY INSTITUTION ..

NEW JERSEY
STATE POLICE INST. OF TECHNOLOGY
TRAINING CENTER - DUNEL
COMMISSIONER OF STATE NATIONAL DEFENSE

ADAM W. ROSE
951.830

1-75347
13 01/15/71 0197.082

00 SEA GRANT PROJECT SUPPORT BY INSTITUTION 00

NEW YORK

COLUMBIA UNIVERSITY PUBLIC EDUCATION PROGRAMS COLUMBIA UNIV. MARINE AFFAIRS PROGRAM UNIV. SCHINER, SPERM WHOLE PROGRAM	17 22 75 03/11/72 883	GIULIO PONTICORVO 300
LAMONT-DHOMBY GEOLOGICAL OBSERVATORY AQUACULTURE - OTHER ANIMALS ARTIFICIAL UPWELLING	01 65 04 05/01/68 840,859	OSWALD A. BOFELS 862,166
MASSACHUSETTS REGIONAL PLANNING BOARD COASTAL ZONE MANAGEMENT SCIENCE AND ENGINEERING COASTAL ZONE MANAGEMENT FOR PLANNING FOR OPTIMUM USE OF MARINE RESOURCES OF COASTAL ZONE	01 22 39 09/01/69 888	CLARE WILLIAMS 300
NEW YORK UNIVERSITY COURSE DEVELOPMENT - OCEAN ENGINEERING CONTINUATION OF A GRADUATE TRAINING PROGRAM IN OCEAN ENGINEERING	01 32 61 05/18/71 811,689	HENRY R. RAPP 817,680
NEW YORK ZOOLOGICAL SOCIETY BIOLOGICALS PHYSIOLOGICALLY ACTIVE SUBSTANCES EXTRACTABLE FROM MARINE SPONGES	01 50 02 01/01/71 8100,000	MARTIN F. STEPHENSON 867,135
STATE UNIV NEW YORK AQUACULTURE - CRUSTACEANS DEVELOPMENT OF BILLET PROJECTS IN AQUACULTURE	03 39 01 11/01/71 825,000	G. W. TERRY 825,056
STATE UNIV NEW YORK COMMERCIAL FISHERIES - BIOLOGY POTENTIAL OF A FISH MARKET COMPREHENSIVE INDUSTRY BASED ON THE LAKE ERIE FISHERY	04 03 39 817,000	R. A. SWEENEY 840,715
STATE UNIV NEW YORK COMMERCIAL FISHERIES - BIOLOGY POLICY FORMULATION AND ECONOMIC AND SOCIAL VALUES OF THE FISHERIES OF NEW YORK STATE	06 03 39 810,000	J. L. MCUGH 810,317
STATE UNIV NEW YORK GEOLOGICAL GEOGRAPHY SEDIMENT AND WATER CHARACTERISTICS IN THE MARINE MTSICIC, EASTERN LONG ISLAND	03 39 03 10/01/71 810,000	R. J. DEFFENHAM 840,210
STATE UNIV NEW YORK MARINE FISHERIES - OTHER DEVELOPMENT OF INDUSTRIAL USES AND CERTAIN MARINE WEEDS	01 39 01 05/01/72 815,000	RENZO LEOPOLDO 840,965
STATE UNIV NEW YORK MARINE FISHERIES - OTHER CONSTITUENTS OF CLADOPHYTES USEFUL IN THE CONTROL OF AQUATIC ORGANISMS	03 39 03 10/01/71 826,049	J.M. JURN 86,604

SEA GRANT PROJECT REPORT BY INSTITUTION **

NEW YORK	STATE-UNIV NEW YORK	REGISTRATION - SPORTS FISHERIES	14	03 19	111,001	I. L. ROUSH
	IMPACT OF GROWN SALMON UPON NEW YORK FISHERMEN AND COMMUNITIES					95,713
	STATE-UNIV NEW YORK	POPULATION - RIVER	19	03 19	129,984	D. A. EILER
	MARINA-BUSINESSES AND USERS IN NEW YORK					111,215
	STATE-UNIV NEW YORK	SOCIO-POLITICAL STUDIES	29	03 19	129,412	WORMAN STABLE
	THE IMPACT OF CHANGES IN LAKE ERIE UPON INCOMES, LAND VALUES, LOCAL TAXES + EMP N CHG + ERIE CO 58-70					129,672
	STATE-UNIV NEW YORK	SOCIO-POLITICAL STUDIES	20	03 19	127,155	G.L. MARSELMAN
	AN ANALYSIS OF FACTORS INVOLVED IN + PRIORITIAL EFFECTIVENESS OF TV FOOD ANNOUNCEMENT IN CHANGING BA					113,945
	STATE-UNIV NEW YORK	SOCIO-POLITICAL STUDIES	23	03 19	129,480	W. E. FORD
	COASTAL ZONE MANAGEMENT OF LAKE ERIE IN THE WESTERN NY REGION - CURRENT STATUS + FUTURE PERSPECTIVES					112,177
	STATE-UNIV NEW YORK	SOCIO-POLITICAL STUDIES	23	03 19	115,403	L. B. DUMOSKY
	INTER-INSTITUTIONAL MANAGEMENT PROBLEMS ON THE GREAT LAKES					127,244
	STATE-UNIV NEW YORK	SOCIO-POLITICAL STUDIES	20	03 19	116,231	M.R. DORFMEISTER
	PLANS + PERSPECTIVES - CASE STUDIES IN SETTING ECOLOGICAL PRIORITIES					119,112
	STATE-UNIV NEW YORK	SOCIO-POLITICAL STUDIES	20	03 19	111,001	D. I. GROM
	PARTICIPATION ACTIVITIES AND METROPOLITAN ECONOMIC GROWTH					111,416
	STATE-UNIV NEW YORK	SOCIO-POLITICAL STUDIES	20	03 19	111,415	WISNET COON
	CITIZEN POLICY- PERCENT AND FUTURE					124,656
	STATE-UNIV NEW YORK	TECHNO SCIENCE AND TECHNOLOGY	15	03 19	112,200	R. S. SHALLMAYER
	USE OF CLM 90-PRODUCTS					111,887
	STATE-UNIV NEW YORK	COASTAL ZONE MGMT SOCIAL SCIENCES	14	03 19	119,204	M K KAUFMANN
	HISTORICAL ASPECTS OF WILLOWS WET ON LONG ISLAND					116,195
	STATE-UNIV NEW YORK	COASTAL ZONE MGMT-NATURAL SCIENCES AND ENGINEERING	19	03 19	115,789	G. W. TERRY
	REGENERATION PROJECT IN WILLOWS DEVELOPMENT					115,010
	STATE-UNIV NEW YORK	COASTAL ZONE MGMT-NATURAL SCIENCES AND ENGINEERING	19	03 19	111,553	RONALD STEWART
	MULTIPLE UTILIZATION OF INTERNAL RESOURCES, BUFFER ZONES AND/OR CORRIDORS					111,084
	STATE-UNIV NEW YORK	COASTAL ZONE MGMT-NATURAL SCIENCES AND ENGINEERING	19	03 19	120,645	RONALD MCNAUGHT
	EVALUATION OF EXISTING IMPROVAL CRITERIA					114,194

** SEA GRANT PROJECT REPORT BY INSTITUTION **

NEW YORK	STATE-UNIV-NEW-YORK	AT 79	PAUL MARK
COASTAL ZONE MGMT-NATURAL SCIENCES AND ENGINEERING	39	911,132	900
MANAGEMENT OF THE NEW YORK COASTAL ZONE- ISSUES FOR PUBLIC POLICY AND PRI-VATE DEVELOPMENT			
STATE UNIV NEW YORK	AT 79	829,081	DONALD R. COATES
COASTAL ZONE MGMT-NATURAL SCIENCES AND ENGINEERING	39	11/01/71	813,826
COASTAL ZONE MGMT-NATURAL SCIENCES AND ENGINEERING			
COASTAL ZONE MGMT-NATURAL SCIENCES AND ENGINEERING			
COASTAL ZONE MGMT-NATURAL SCIENCES AND ENGINEERING			
STATE UNIV NEW YORK	AT 79	8125,000	D. F. SQUIRRES
ECOSYSTEMS RESEARCH	40		900
DEVELOPMENT OF A PRELIMINARY ATLAS OF THE MARINE ENVIRONMENT OF NEW YORK			
STATE-UNIV-NEW-YORK	AT 79	815,823	IVER DUKEDALL
ENVIRONMENTAL GOALS - OTHER	40	11/01/71	81,253
DEVELOPMENT OF A MANAGEMENT MODEL FOR WESTERN LONG ISLAND SOUND			
STATE UNIV NEW YORK	AT 79	917,968	D. F. SQUIRRES
FUNCTION - OTHER	70	09/15/72	816,857
SCIENTIFIC ADVISORY INTERCOMMS FOR THE NEW YORK STATE ASSEMBLY			
STATE UNIV NEW YORK	AT 79	967,220	D. F. SQUIRRES
PROGRAM ADMINISTRATION	79	11/01/72	816,566
PROGRAM MANAGEMENT			
STATE-UNIV-NEW-YORK	AT 79	819,016	D. F. SQUIRRES
PROGRAM LOGISTIC SUPPORT	40		85,873
CENTRAL SERVICES - NEW YORK STATE SEA GRANT PROGRAM			
STATE UNIV NEW YORK	AT 79	917,571	D. F. SQUIRRES
NEW APPLICATIONS DEVELOPMENT	41		810,599
NEW INITIATIVES			

00 SEA GRANT PROJECT REPORT BY INSTITUTION **

UNIT	PROJECT TITLE	PI	DATE	AMOUNT	PI NAME
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	07	07/01/77	917,703	WILLIAM W MASSLEO
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	08	07/01/77	917,703	WILLIAM W MASSLEO
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	06	07/01/77	911,674	FORWARD P RYAN
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	04	01/60	81,607	PHYLLIS G. BOBROWNY
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	09	01/01/77	922,335	ROY L. LEGGAN
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	10	07/01/77	925,024	STANLEY B. BIGGS
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	15	07/01/77	94,197	SYLVANUS W. WOFFEL
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	24	07/01/77	912,723	G. C. TUNG
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	25	01/60	812,065	WALTER E. MURPHY
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	35	07/01/77	924,315	WILLIAM W. MASSLEO
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	39	07/01/77	89,444	JAMES P. BARNWELL
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	10	07/01/77	914,911	M. W. WOODRUFF, JR.
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	19	07/01/77	85,009	M. V. CAMPBELL
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	19	07/01/77	817,554	D. C. BIRRELL
UNIV OF NORTH CAROLINA	RESEARCH - FISHING	25	07/01/77	971,655	R. J. CORLIAM

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UNIV OF NORTH CAROLINA						
UNIV OF NORTH CAROLINA						
ENVIRONMENTAL MODELS - PHYSICAL PROCESSES	66	07/01/70	322,000	M AMEIN	911,660	
DYNAMICS OF FLOW IN ESTUARINE WATERS						
UNIV OF NORTH CAROLINA						
EXTENSION AGENT SERVICES	71	07/01/70	801,000	JOHN P GAWANA	421,950	
THE DEVELOPMENT OF MARINE INDUSTRY HARVESTING AND PROCESSING SYSTEMS -						ENGINEERING ADVISORY SERV
UNIV OF NORTH CAROLINA						
EXTENSION AGENT SERVICES	71	07/01/70	320,170	FRANK S THOMAS	310,800	
DEVELOPMENT OF MARINE INDUSTRIES HARVESTING AND PROCESSING SYSTEMS - SFA-						FOOD SCI & TECH ADV SERV
UNIV OF NORTH CAROLINA						
EXTENSION AGENT SERVICES	72	07/01/70	319,310	JAMES A MCGEE	319,600	
CONTINUING EDUCATION PROGRAM FOR COMMERCIAL FISHERMEN						
UNIV OF NORTH CAROLINA						
PUBLICATIONS, UMIA VIGILS, ETC.	76	07/01/70	90,520	A F CHRISTIUT	90,260	
UPDATED - SURVEY OF MARINE FISHERIES-						
UNIV OF NORTH CAROLINA						
PROGRAM ADMINISTRATION	79	07/01/65	326,555	JOHN LYMAN	311,233	
PROGRAM ADMINISTRATION AND DEVELOPMENT						
UNIV. OF N. C.- WRIGHTSVILLE MARINE RESEARCH FOUNDATION						
VEHICLES, VESSELS, AND PLATFORMS	23	11/10/71	400	RALPH BRUER	300	
MEMOR. USE OF RES. SUMMERSTAY IN BASIC & APPLIED RES. IN MAR. SCI. ON THE N.C. CONTINENTAL SHELF						

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OKLAHOMA
UNIV OF OKLAHOMA
MEDICAL
CENTRAL

ANTHROPOL
01 54
12 03/22/77 379.603

A J WEINSTEIN
379.603

PROJECT TITLE	PI	DATE	AMOUNT
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - CRUSTACEANS AQUICULTURE (CRABFISH)	J. DONALDSON	01 07/01/71	911,915
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	M. J. MCNEIL	07 02/29/68	663,637
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	P. S. CALDWELL	07	912,444
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	J. GONOR	07 02/29/68	863,986
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	M. P. ARZUFF	07 12/29/68	996,227
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	G. D. MCINTYRE	07 02/29/68	914,222
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	A. GARY	07 12/29/68	914,100
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	M. GUOL	07 02/29/68	991,496
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	G. MILLER	07 02/29/68	912,948
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	J. L. FOYER	08 07/05/71	919,881
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	I. PRATT & P. E. NELSON	08 12/29/68	951,421
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	G. CONSTANTINE & P. CATALANO	12 07/01/71	921,983
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	F. J. SMITH	16 07/01/79	926,146
OREGON STATE UNIV BIOPHYSICAL CHEMISTRY - FISH AQUICULTURE (SALMON)	R. A. WELTIC	16 02/29/68	917,812

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INSTITUTION	PROJECT TITLE	DATE	AMOUNT	PI
OREGON				
OREGON-STATE UNIV	MARINE ECONOMICS	01 84	961,451	J R STEVENS
	PUBLIC POLICY IN THE MARINE RESOURCES INDUSTRIES	16 02/28/68		912,138
OREGON STATE UNIV	MARINE ECONOMICS	01 84	912,751	D S JOHNSON
	MARKETING, ADVICE AND MARKETING OF SEAFARM PRODUCTS	14 12/29/68		916,231
OREGON STATE UNIV	OCEAN LAW - COASTAL	01 84	911,691	J L JACOBSON
	OCEAN RESOURCES LAW	15 07/29/68		914,982
OREGON-STATE-UNIV	INDUSTRIAL SYSTEMS- INNOVATION AND THE OREGON FISH HARVEST SYSTEMS- IMPACTS OF LIMITED ENTRY	01 84	913,080	G L SMITH
		23 07/29/68		916,614
OREGON STATE UNIV	MATERIALS AND STRUCTURES	01 84	929,071	J M MATI
	DESIGN AND RESEARCH FOR OCEAN AND HEADSHORE STRUCTURES	24 07/29/68		922,966
OREGON STATE UNIV	COASTAL ENGINEERING	01 84	916,236	L S SLATA
	ESTUARINE HYDRAULICS	25 07/29/68		929,632
OREGON STATE UNIV	OPENING	01 84	924,666	L S SLATA
	OPENING CONCEPTS AND CONSEQUENCES	27 01 84		927,216
OREGON STATE UNIV	OCEAN ENGINEERING - OMER	01 84	923,879	J HINGLF
	MECHANIZATION OF FISHING GEAR	28 06/01/71		916,556
OREGON STATE UNIV	OCEAN ENGINEERING - OMER	01 84	919,202	M F ENGSTED
	INDUSTRIAL ENGINEERING-SYSTEMS STANDARDS FOR SHIPING, GEAR, AND DEVELOPMENT OF COMMERCIAL FISHING METHODS AND GEAR	29 02/29/68		922,975
OREGON STATE UNIV	COMMERCIAL FISHERIES - TECHNOLOGY	01 84	932,661	D A FISHER
	DEVELOPMENT OF COMMERCIAL FISHING METHODS AND GEAR	10 10/01/69		95,000
OREGON STATE UNIV	SEAFARM SCIENCE AND TECHNOLOGY	01 84	921,943	D L GRAFFSON
	NEW SPECIES AND PRODUCT DEVELOPMENT	16 02/29/68		927,247
OREGON STATE UNIV	SEAFARM SCIENCE AND TECHNOLOGY	01 84	946,631	D L GRAFFSON
	QUALITY IMPROVEMENT AND SANITATION	15 12/29/68		910,167
OREGON-STATE UNIV	SEAFARM SCIENCE AND TECHNOLOGY	01 84	915,693	J S LEF
	NEW EQUIPMENT AND PROCESS DEVELOPMENT	15 02/29/68		923,689
OREGON STATE UNIV	SEAFARM SCIENCE AND TECHNOLOGY	01 84	946,647	D D SINNURCO
	SEAFARM SCIENCE AND TECHNOLOGY	16 02/29/68		914,027
	WATERLION AND WASTE UTILIZATION			

00 SEA GRANT PROJECT REPORT BY INSTITUTION 00

INSTITUTION	PROJECT TITLE	DATE	AMOUNT	PI
OREGON STATE UNIV	APPLIED PHYSICAL OCEANOGRAPHY SEA AND SHIP ENGINEERING	81 06 80 07/01/70	86,979	M V ROSE 800
OREGON STATE UNIV	APPLIED PHYSICAL OCEANOGRAPHY	83 06 80 07/01/70	94,016	S MESHARA 810,506
OREGON STATE UNIV	APPLIED PHYSICAL OCEANOGRAPHY	81 06 80 07/01/70	84,353	PAUL D EDWARDS 800
OREGON STATE UNIV	CLUSE DEVELOPMENT - ECONOMICS MARINE ECONOMICS - EDUCATION AND TRAINING	81 06 80 07/20/68	95,383	P B RITTIG 83,279
OREGON STATE UNIV	CLUSE DEVELOPMENT - AQUICULTURE	81 06 80 07/20/68	816,890	M F HORTON 800
OREGON STATE UNIV	CLUSE DEVELOPMENT - OCEAN ENGINEERING	81 06 80 07/20/68	819,653	L S SLOTTA 863,256
OREGON STATE UNIV	OCEANOGRAPHIC TECHNICIAN TRAINING	83 06 80 07/20/68	839,925	D J BRIGGEM 816,586
OREGON STATE UNIV	COMMERCIAL FISHERIES TRAINING	82 06 80 12/01/71	836,186	A AMENSON 813,556
OREGON STATE UNIV	TECHNICIAN TRAINING - OTHER	81 06 80 07/20/68	874,723	D L MRODLUGH 812,698
OREGON STATE UNIV	TECHNICIAN TRAINING - CIVIC	81 06 80 12/19/71	814,661	J R HARGIS 810,916
OREGON STATE UNIV	EXTENSION AGENT SERVICES	81 06 80 06/25/72	825,313	D A PANSHIN 86,001
OREGON STATE UNIV	EXTENSION AGENT SERVICES	83 06 80 07/20/68	829,924	D A PANSHIN 86,975
OREGON STATE UNIV	EXTENSION AGENT SERVICES	81 06 80 07/20/68	827,000	K S HILDEBRAND, JR 87,031
OREGON STATE UNIV	EXTENSION AGENT SERVICES	83 06 80 07/20/68	824,017	F J SMITH 86,721

AGENCY	PROJECT NUMBER	BY INSTITUTION	AS OF 04/30/73	PAGE
AMERICAN STATE UNIT MISSIONARY SERVICE MIDWEST REGIONAL OFFICE	21	03 06 07/20/64	997,553	W A WICE 910,524
AMERICAN STATE UNIT PUBLIC EDUCATION PROGRAMS MIDWEST REGIONAL OFFICE	25	03 06 06/25/72	989	A C GILES 976,928
AMERICAN STATE UNIT PUBLICATIONS, AUDIO VISUALS, ETC. MIDWEST REGIONAL OFFICE	26	03 06 07/20/64	996,587	G O EVANS 919,156
AMERICAN STATE UNIT PUBLICATIONS, AUDIO VISUALS, ETC. MIDWEST REGIONAL OFFICE	27	03 11 01/31/72	961,987	W A WICE 922,590
AMERICAN STATE UNIT PUBLICATIONS, AUDIO VISUALS, ETC. MIDWEST REGIONAL OFFICE	29	03 06 07/31/64	999,566	PROGRAMS & COMPLAINTS 916,366
AMERICAN STATE UNIT PUBLICATIONS, AUDIO VISUALS, ETC. MIDWEST REGIONAL OFFICE	31	03 11 07/31/70	925,903	W F FORNBERG 979,122
AMERICAN STATE UNIT PUBLICATIONS, AUDIO VISUALS, ETC. MIDWEST REGIONAL OFFICE	36	03 06	976,403	DR. JIMM HOOVILLER 935,872

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UNIV OF MICHIGAN ISLAM							
UNIV OF MICHIGAN ISLAM							
ADMICULTURE - CHRISTIANISM	01	07/01/74	011,454				G SASTRY & S CHAO 01,911 AMERICANUS-
SELECTED PROBLEMS IN THE CULTURE OF AMERICAN LOGGERS, -MOROUS							
UNIV OF MICHIGAN ISLAM							J MCN SIERMITH 03,296
ADMICULTURE - PIRATH	02	07/01/70	024,519				
ORGANIZATION AND SACERDOTALITY OF HISTORICAL FILIPPOS							
UNIV OF MICHIGAN ISLAM							
ADMICULTURE - PIRATH	02	07/01/70	027,000				T L MCARD 05,175
MANAGEMENT OF SALMONS IN A CLOSED REGULATING CONTROLLED ENVIRONMENT SYSTEM							
UNIV OF MICHIGAN ISLAM							
COMMERCIAL FISHERIES - RINLOGY	06	07/01/68	027,031				SAUL M SALLA 013,112
FISHERIES REGULATION TECHNIQUES - RES PHASE							
UNIV OF MICHIGAN ISLAM							
PATHOLOGY OF MARINE ORGANISMS	04	07/01/74	010,000				O C WOLKE 06,000
MARINE MALARIA							
UNIV OF MICHIGAN ISLAM							
GENETICALS	12	07/01/68	012,106				GARY P CARLTON & JOHN DEGEN 07,000
MARINE MALARIA							
UNIV OF MICHIGAN ISLAM							
GENETICALS	12	07/01/68	011,572				L D WHITMAN / M W YOUNGER 010,000
MARINE MALARIA							
UNIV OF MICHIGAN ISLAM							
MARINE ECONOMICS	16	07/01/70	016,063				MARLAN LAMP 01,101
ECONOMIC-ECONOMICAL MODEL OF MARGINALIST AND RASIN							KENNETH MCCONNELL 01,015
UNIV OF MICHIGAN ISLAM							
MARINE ECONOMICS	16	07/01/70	010,700				THOMAS A COICALUMAS 01,015
ECONOMIC ASPECTS OF MULTIPLE USE COASTAL ZONE PLANNING							
UNIV OF MICHIGAN ISLAM							
MARINE ECONOMICS	16	07/01/70	026,207				V HORTON / J GATES 01,572
ECONOMIC ASPECTS OF MULTIPLE USE COASTAL ZONE PLANNING							
UNIV OF MICHIGAN ISLAM							
MARINE ECONOMICS	16	07/01/70	027,326				JOHN PAGEE / CARL GROSSMAY 05,250
ECONOMICS OF WATER RESOURCES IN MARINE ENVIRONMENT							
UNIV OF MICHIGAN ISLAM							
MARINE ECONOMICS	16	07/01/71	010,510				V HORTON / J GATES 01,572
SOCIO-ECONOMIC STUDY OF FISHERIES OCCUPATIONS							
UNIV OF MICHIGAN ISLAM							
MARINE ECONOMICS	16	07/01/71	010,321				A HOLMSEN 02,070
SOCIO-ECONOMIC STUDY OF FISHERIES OCCUPATIONS							
UNIV OF MICHIGAN ISLAM							
MARINE ECONOMICS	16	07/01/71	010,531				
MANAGEMENT SYSTEM FOR FISH RESOURCES IN NEW ENGLAND							
UNIV OF MICHIGAN ISLAM							
MARINE ECONOMICS	16	07/01/71	010,531				
EVALUATION OF THE DECATUR 1970 AGREEMENT IN THE MERCHANT MARINE ACT							

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UNIVERSITY	PROJECT TITLE	PROJECT NUMBER	START DATE	END DATE	AMOUNT	PI
UNIV OF MARYLAND	UNIV OF MARYLAND - ISLAND POLLUTION - RESEARCH	52	07/01/68	01/01/70	\$19,950	31 03
	ECOLOGICAL MANAGEMENT OF SHALLOW AND PRODUCTIVE BRACKISH ENVIRONMENTS					
UNIV OF MARYLAND	ENVIRONMENTAL MODELS - PHYSICAL PROCESSES	56	07/01/74	02/01/75		03 03
	ANALYTICAL-MATHEMATICAL MODEL					
UNIV OF MARYLAND	COURSE DEVELOPMENT - ECONOMICS	55	07/01/71	01/01/75		03 03
	PH. D. IN ECONOMICS - MARINE RESOURCE ECONOMICS OPTION					
UNIV OF MARYLAND	GROUP DEVELOPMENT - OCEAN ENGINEERING	61	07/01/71	01/01/75		03 03
	JOINT PROGRAM IN OCEAN AND MECHANICAL ENGINEERING					
UNIV OF MARYLAND	COURSE DEVELOPMENT - OCEAN ENGINEERING	61	07/01/71	01/01/75		03 03
	GRADUATE PROGRAM IN OCEAN ENGINEERING					
UNIV OF MARYLAND	COURSE DEVELOPMENT - OTHER	62	07/01/69	02/01/70		03 03
	MASERS OF MARINE AFFAIRS					
UNIV OF MARYLAND	COMMERCIAL FISHERIES TRAINING	66	07/01/68	01/01/73		03 03
	FISHERIES & MARINE TECHNOLOGY EXTENSION PROGRAMS - OTHER					
UNIV OF MARYLAND	EXTENSION PROGRAMS - OTHER	73	07/01/74	01/01/77		03 03
	JOI-MARINE ADVISORY SERVICE					
UNIV OF MARYLAND	COMPUTERS, INSTRUMENTS, ETC	76				03 03
	LAM OF THE SEA INSTITUTE					
UNIV OF MARYLAND	ADVISORY SERVICES - OTHER	77	07/01/68	01/01/75		03 03
	AN ENGLISH MARINE RESOURCES INFORMATION PROGRAM (MORIMP)					
UNIV OF MARYLAND	PROGRAM PLANNING	78				03 03
	IMP-USE AND IMPACT OF MARINE PRACTICES					
UNIV OF MARYLAND	PROGRAM ADMINISTRATION	79	07/01/71	01/01/77		03 03
	PROGRAM ADMINISTRATION					

GEORGE T. FELLECKE, JR.
\$7,251

FRANK N. WHITE
\$4,526

JOHN RATES / VIRGIL MORTON
\$5,159

HERMAN E. SHEFFS
\$19,645

HERMAN E. SHEFFS
\$105,000

LEWIS M. ALEXANDER
\$14,161

JOHN C. BATHMUNY
\$109,385

WALTER GRAY
\$4,000

LEWIS M. ALEXANDER
\$41,556

WALTER GRAY
\$7,350

F. JOHNSON / A. DELLA BITTA
\$1,765

NIELS ØRSKOV
\$00

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SOUTH CAROLINA					
MARINE RESOURCES CENTER					
ANUACUA TURT - CHYSTAGANS	01	3172	510,000	PAUL A. SAMMIFER	56,000
THE INITIAL FISH CULTURE OF CORN- ROACHISH WATER SHIMP -MACROBRACHIUM-IN S. C. RICE FIELDS					
MARINE RESOURCES CENTER	03	3372	912,000	V.C. RUMFELL, JR.	819,000
GENACULTURE - MOLLUSCS					
FAUNA OF MATRICAL--WOLLY. OCCUPING CATCH-FREE SPAT OF AMPH. WASTED, CRASSOSTRGA VIRGINICA					
MARINE RESOURCES CENTER	04	3372	912,000	RAY T. SARVER	85,500
COMMERCIAL FISHERIES - MOLLUSCS					
POPULATION DYNAMICS OF THE ATLANTIC WINKLE, BREVORTERIA TIRANOSUS, IN THE ESTUARIES OF SOUTH CAROLINA					
MARINE RESOURCES CENTER	25	3372	912,000	WM. HARON, RILLY FOSG, RPHJ, DYSADT	86,100
COASTAL FISHING					
UTILIZATION OF WENCH BIVALVAL AREAS IN SOUTH CAROLINA					
MARINE RESOURCES CENTER	26	3372	919,000	H.K. WEBB	86,172
FISHERIES - ANUACULTURE					
DESIGN AND DEVELOPMENT OF EQUIPMENT FOR AQUACULTURAL ADMINISTRATION					
MARINE RESOURCES CENTER	35	00/01/72	96,000	G.L. HARTH	81,500
STRAND SCIENCE AND TECHNOLOGY					
DEVELOPMENT OF IN-PLANT REACTORS, TO IMPROVE EFFICIENCY OF UTILIZATION & TO REDUCE WASTE IN SEAFARM REARING					
MARINE RESOURCES CENTER	30	3372	925,000	J. MITC, D. PUGH, F. JAYSON	819,500
COASTAL ZONE MARINE SCIENCE					
A PROGRAM RESEARCH TO DOCUMENT AND ASSESS THE MARINE RESOURCES OF SOUTH CAROLINA					
MARINE RESOURCES CENTER	60	04/01/72	910,600	L. HAROLD STEVENSON	915,039
FISHERIES RESEARCH					
MARSH PRODUCTION AND EFFECTS OF ENVIRONMENTAL PERTURBATIONS--BIOCHEMISTRY AND MARSH MICROBIOLOGY					
MARINE RESOURCES CENTER	60	04/01/72	920,001	M.B. VERBORNE	80,000
FEEDSTOCK RESEARCH					
MARSH PRODUCTION--EFFECTS OF ENVIRONMENTAL PERTURBATIONS - PATHOLOGY, IMMUNO-PATHOLOGY-LARVAL JOINTPLANKTON					
MARINE RESOURCES CENTER	62	04/01/72	92,000	HARRY FREEMAN	81,000
COURT DEVELOPMENT - BIRD					
COURT DEVELOPMENT GENERAL MARINE SCIENCE					
MARINE RESOURCES CENTER	76	02/01/72	925,000	M. COLBEN-H. ROBERT	921,234
PUBLICATIONS, MARINE VISUALS, ETC.					
SEA-GRASS AND TROPIC REEF					

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INSTITUTION	PROJECT TITLE	DATE	AMOUNT	PI
TEXAS				
TEXAS-A-AND-M UNIV	AQUACULTURE - CRUSTACEANS	01 09/01/71	119,000	JACK C BARBER 014,644
	..... Shellfish CULTURE			
TEXAS A-AND-M UNIV		01 09/01/71	117,375	DAVID V ALDRICH 01,576
	AQUACULTURE - CRUSTACEANS			
	..... TEMPERATURE TOLERANCE AND ACCLIMATION OF BROWN AND WHITE SHRIMP (PENAEUS AZTECUS AND P. SETIFERUS)			
TEXAS A AND M UNIV		01 10	11,700	STERLING K JOHNSON 11,644
	AQUACULTURE - CRUSTACEANS			
	..... DIAGNOSIS AND TREATMENT OF SHRIMP DISEASES IN PONDS			
TEXAS-A-AND-M-UNIV		01 09/01/71	115,000	M W LEWIS 110,371
	AQUACULTURE - CRUSTACEANS			
	..... MICROBIAL DISEASES OF POND-REARED SHRIMP			
TEXAS A AND M UNIV		01 10	110,116	CARL VANDEBRANT 11,736
	AQUACULTURE - CRUSTACEANS			
	..... SANITARY QUALITY AND SAFE LIFE OF POND-REARED SHRIMP			
TEXAS A AND M UNIV		01 07/01/71	113,000	JOSEPH L MCELNICK 115,135
	PATHOLOGY OF MARINE ORGANISMS			
	..... ASSESSMENTS OF POTENTIAL PUBLIC HEALTH HAZARDS IN TEXAS COASTAL WATERS			
TEXAS-A-AND-M UNIV		01 10	119,500	WILLIS E SPANGLER 111,541
	BIOTECHNICALS			
	..... DEVELOPMENT OF OCEAN SOURCES OF SELECTED PHARMACEUTICALS			
TEXAS A AND M UNIV		01 10	111,000	NORMAN C WHITEHEAD 17,500
	MARINE ECONOMICS			
	..... MARINE TOURISM ANALYSES			
TEXAS A AND M UNIV		01 10	119,000	WILLIE T INGRAM 111,000
	RECREATION - OTHER			
	..... ECONOMIC IMPACT OF RECREATION AND TOURISM			
TEXAS-A-AND-M UNIV		01 10	106,000	WILLIAM R ROYANT 17,286
	STRUCTURE ENGINEERING			
	..... SPANNS STABILITY-COASTLINE WATERS, GULF OF MEXICO			
TEXAS A AND M UNIV		01 10	121,000	RICHARD DOMINGUEZ AND WAYNE NUNLAP 11,000
	MATERIALS AND STRUCTURES			
	..... OFFSHORE PLATFORMS			
TEXAS A AND M UNIV		01 10	116,000	JOHN W NICHOLS 14,119
	COMMERCIAL FISHERIES - TECHNOLOGY			
	..... MARKET EVALUATION OF SELECTED SPECIES OF FISH FISHES OF THE WESTERN GULF OF MEXICO			
TEXAS-A-AND-M UNIV		01 10	124,150	JAMES G IFFER 120,821
	COMMERCIAL FISHERIES - TECHNOLOGY			
	..... EVAL OF POTENTIAL FISHERIES OF UNDERUTILIZED SPECIES OF FISH FISHES IN TAMPAIC BAY GULF OF MEXICO			
TEXAS A AND M UNIV		01 10	124,000	EDWARD L ALCEMAN 17,522
	DIVER PHYSIOLOGY			
	..... DECOMPRESSION TABLES FOR POST SATURATION DIVING			

00 EPA GRANT PROJECT REPORT BY INSTITUTION **

INSTITUTION	PROJECT TITLE	DATE	AMOUNT	PI
TEXAS A AND M UNIV	SEAFARM SCIENCE AND TECHNOLOGY MONITORING-SEAFARM MARQUETING FACILITIES	01 10	910,347	S M GILLESPIE AND R STODOLILL 041,004
TEXAS A AND M UNIV	SEAFARM SCIENCE AND TECHNOLOGY EFFECTS OF POLLUTING ON SEAFARM FISH	01 10	84,107	RYAN T F COOK III 024,000
TEXAS A AND M UNIV	SEAFARM SCIENCE AND TECHNOLOGY FISHERY PRODUCT PROCESSING - SANITATION, QUALITY CONTROL, NEW PRODUCT DEVELOPMENT	01 10	910,337	CARL WANDERZANT 041,046
TEXAS A AND M UNIV	SEAFARM SCIENCE AND TECHNOLOGY FACTORS AFFECTING VESSEL STABILITY AND SURVIVAL SHEEP LIVER AND SKIN SPECIES OF FISH FISHES	01 10	924,362	RYAN T F COOK III 041,246 R M LEWIS 014,514
TEXAS A AND M UNIV	SEAFARM SCIENCE AND TECHNOLOGY ECONOMIC AND HEALTH ASPECTS IN UNDERUTILIZED SPECIES OF FISH	01 10	924,104	JAMES R BRADLEY 012,500
TEXAS A AND M UNIV	WATER POLLUTION AND WASTEWATER TREATMENT	01 10	927,007	JOHN WILCOX 041,000
TEXAS A AND M UNIV	TRANSPORTATION SYSTEMS - OTHERS GULF INTRACASTAL WATERWAY OF TEXAS	01 10	914,000	MOT A RICHARDS 010,400
TEXAS A AND M UNIV	TRANSPORTATION SYSTEMS - OTHERS TRANSPORTATION OF WATERBORNE HAZARDOUS MATERIALS IN THE WEST GULF COASTAL REGIONS OF TEXAS	01 10	915,400	GEORGE B DRESSER AND WAYNE E EITER 041,251
TEXAS A AND M UNIV	TRANSPORTATION SYSTEMS - OTHERS FINANCIAL PLANNING AND TRUCK WATERWAYS AND HARBORS	01 10	916,429	ALBERT SCHAEFER 041,000
TEXAS A AND M UNIV	COASTAL ZONE SCIENCE AND POLICY ON COASTAL RESOURCES	01 10	94,500	TAMMY M RAY 024,000
TEXAS A AND M UNIV	COASTAL ZONE SCIENCE AND POLICY ON COASTAL RESOURCES	01 10	917,000	C P TORCO 014,200
TEXAS A AND M UNIV	COASTAL ZONE SCIENCE AND POLICY ON COASTAL RESOURCES	01 10	911,000	ROY W HAHM, JR 004,500
TEXAS A AND M UNIV	COASTAL ZONE SCIENCE AND POLICY ON COASTAL RESOURCES	01 10	915,607	ROBERT H SCHMIDT 011,450
TEXAS A AND M UNIV	COASTAL ZONE SCIENCE AND POLICY ON COASTAL RESOURCES	01 10	917,500	ROBERT H SCHMIDT 011,450
TEXAS A AND M UNIV	COASTAL ZONE SCIENCE AND POLICY ON COASTAL RESOURCES	01 10	917,500	ROBERT H SCHMIDT 011,450

00 STA GOVT PROJECT REPORT BY INSTITUTION 00

TEXAS							
TEXAS-A AND M UNIV	COASTAL ZONE MGMT-NATURAL SCIENCES AND ENGINEERING	19	07 14	916,484	ROY M MAHON, JR	97,500	
	CONTROL OF HAZARDOUS MATERIALS IN THE COASTAL ZONE						
TEXAS A AND M UNIV	ECOSYSTEMS RESEARCH	60	07 10	930,200	MAYNE M AMR	814,273	
	MATACORDA-BAY PROJECT						
TEXAS A AND M UNIV	POLLUTION - OTHER	45	07 10	912,400	DAVID R BASCO	97,636	
	A STUDY OF PRECEDE SPILL DISPERSION IN GALVESTON BAY						
TEXAS-A AND M UNIV	POLLUTION - OTHER	45	07 10	919,750	RICHARD A GEYER	89,174	
	A STUDY OF NATURAL HYDROCARBON STORAGE IN THE GULF OF MEXICO						
TEXAS A AND M UNIV	POLLUTION - OTHER	45	07 10	912,400	J FRANK SLOMEY	97,500	
	REMOVAL, TREATMENT & DISPOSAL OF SOLIDWASTES CONTAINING INDUSTRIAL WASTES						
TEXAS A AND M UNIV	ENVIRONMENTAL MODELS - PHYSICAL PROCESSES	66	07 14	923,400	ROBERT E SCHILLER	812,923	
	ENVIRONMENTAL SIMULATION AND MODELING						
TEXAS-A AND M UNIV	COURSE DEVELOPMENT - FISHERIES	59	07 14	87,450	JAMES G TEER	95,074	
	TEACHING AND COURSE DEVELOPMENT IN FISHERIES						
TEXAS A AND M UNIV	COURSE DEVELOPMENT - OCEAN ENGINEERING	61	07 14	927,700	P F SCHILLER AND F L KISTLEP	814,196	
	DEVELOPMENT OF UNDERGRADUATE AND GRADUATE PROGRAMS IN OCEAN ENGINEERING						
TEXAS A AND M UNIV	COURSE DEVELOPMENT - OTHER	62	07 14	95,000	WESLEY P JAMES	87,000	
	MEDIA AND EXT DEVELOPMENT IN ENVIRONMENTAL ENGINEERING						
TEXAS-A AND M UNIV	COURSE DEVELOPMENT - OTHER	62	07 14	99,400	CLINTON A PHILLIPS	96,000	
	DEVELOPMENT OF U.S. CURRICULUM IN MARINE SCIENCE MANAGEMENT						
TEXAS A AND M UNIV	COURSE DEVELOPMENT - OTHER	62	07 14	94,400	D M LEWIS	82,937	
	GRADUATE COURSES IN AQUATIC ANIMAL MEDICINE						
TEXAS A AND M UNIV	TECHNICIAN TRAINING - OTHER	67	07 10	921,300	F D TIDDLFOTM	812,990	
	OCEANIC AND MARINE TECHNOLOGY						
TEXAS-A AND M UNIV	TECHNICIAN TRAINING - OTHER	67	07 14	99,400	WILLIAM M SCHROEDER	96,162	
	MARINE OCEAN TRAINING FOR UNDERGRADUATE APPLIED SCIENCE						
TEXAS-A AND M UNIV	EDUCATION - OTHER	70	07 10	912,400	DOUGER D ANDERSON	86,200	
	EDUCATIONAL-IMPROVEMENT						

CO STATE GOVT PROJECT REPORT BY INSTITUTION **

PROJECT DESCRIPTION	REPORT NO.	DATE	AMOUNT	PERSONNEL
TEXAS SEARCH-AND-REVIEW PUBLICATIONS, AUDIO VISUALS, ETC. DEPARTMENT OF MARINE RESOURCES INFORMATION	76	07/10 07/01/77	\$185,000	LAFAYE F MILBY \$16,000
TEXAS-A AND M UNIT ADVISORY SERVICES - STMP WFM ADVISORY PROJECT INITIATION	77	07/10	\$11,160	WILLIS H CLARK \$7,671
TEXAS A AND M UNIT ADVISORY SERVICES - STMP ADVISORY SERVICES AND INVESTIGATE	77	07/10 07/01/77	\$10,400	NORMAN C WHITEHOOD \$6,000
TEXAS-A-AND-M UNIT PROGRAM PLANNING RESEARCH PROGRAM COMMUNICATION	78	07/10	\$27,900	WILLIS H CLARK \$16,000
TEXAS A AND M UNIT PROGRAM PLANNING PROGRAM MANAGEMENT	79	07/10 07/01/77	\$15,000	ROBERT C STEPHENSON \$5,240
TEXAS A AND M UNIT WFM APPLICATIONS DEVELOPMENT RESEARCH PROGRAMS DEVELOPMENT	81	07/10 07/01/77	\$17,900	WILLIS H CLARK \$2,740

00 SEA GRANT PROJECT REPORT BY INSTITUTION 00

INSTITUTION	PROJECT TITLE	PI	DATE	AMOUNT	PI NAME	PI ADDRESS
VIRGINIA	VIRGINIA-INSTIT OF MARINE SCIENCE	03 69			J.-L. DUMUY + J.-P. ANDREWS	
	AQUACULTURE - MOLLUSCS	03 12/01/68	036,800		948,964	
	PRODUCTION OF SUPERIOR SYSTEMS, MANAGEMENT OF LARVAE AND FOOD FOR MARE - CULTURE					
VIRGINIA INST OF MARINE SCIENCE	AQUACULTURE - MOLLUSCS	01 69			M. CASTAGNA	
	IMPROVEMENT OF FISHERIES FOR MOLLUSCS	01 12/01/68	917,800		812,936	
VIRGINIA INST OF MARINE SCIENCE	AQUACULTURE - OTHER ANIMALS	03 69			J.-A. LANIER	
	PREPARATION OF AN INFORMATION RISE IN AQUACULTURE	04		910,800	900	
VIRGINIA-INSTIT OF MARINE SCIENCE	COMMERCIAL FISHERIES - TECHNOLOGY	03 69			M.-A. VAN ENGEL	
	IMPROVEMENT OF FISHERIES FOR CRUSTACEANS	03 12/01/68	926,200		994,901	
VIRGINIA INST OF MARINE SCIENCE	APPLIED PHYSICAL OCEANOGRAPHY	01 69			V. GOLDSMITH	
	STUDY OF OCEAN WAVE AERATION FOR VIRGINIA'S OCEAN COASTLINE	01 01/01/72	916,800		818,718	
VIRGINIA INST OF MARINE SCIENCE	EXTENSION PROGRAMS - OTHER	03 69			M.-J. MARCIS	
	ADVISORY SERVICES (EXTENSION AGENTS AND PUBLICATIONS)	71 01/15/70	950,000		939,689	
VIRGINIA INST OF MARINE SCIENCE	PROGRAM ADMINISTRATION	03 69			M.-J. MARCIS	
	SEA GRANT PROGRAM ADMINISTRATION, PLANNING AND COORDINATION	79 12/01/68	917,800		913,913	
VIRGINIA POLYTECHNIC INSTITUTE	EXTENSION PROGRAMS - OTHER	2-3532			GEORGE J. FLECK	
	SEAFARER PROFESSIONS EXTENSION ADVISORY SERVICE	73 12/01/71	900		900	

** FEA GRANT PROJECT REPORT BY INSTITUTION **

UNIT OF WASHINGTON	PROJECT TITLE	DATE	AMOUNT	PI
UNIVERSITY OF WASHINGTON	AGRICULTURE - FISHING	07 07/28/68	\$100,000	ROY F. MAKAFANT
	Improving salmon aquaculture			\$50,000
UNIVERSITY OF WASHINGTON	AGRICULTURE - MOLLUSKS	03 02/28/68	\$75,000	ROY F. MAKAFANT
	Improving marine bivalve aquaculture			\$15,000
UNIVERSITY OF WASHINGTON	AGRICULTURE - PLANTS	05 01/01/71	\$11,100	RICHARD E. MORRIS
	Aquaculture of marine algae			\$11,100
UNIVERSITY OF WASHINGTON	COMMERCIAL FISHERIES - BIOLOGY	03 03 02	\$19,200	ROBERT L. BUECHER
	Development of management plans for Lake Washington sockeye salmon	06 09/15/68	\$19,200	\$19,100
UNIVERSITY OF WASHINGTON	COMMERCIAL FISHERIES - BIOLOGY	06 01/01/72	\$10,000	RICHARD F. THORPE
	Evaluation of acoustic techniques of resource assessment			\$16,500
UNIVERSITY OF WASHINGTON	BIOMATERIALS	17 01/01/72	\$16,000	SAMUEL P. ELLIOT
	Seaweed			\$9,500
UNIVERSITY OF WASHINGTON	MARINE CHEMISTRY - OTHER	13 01/01/72	\$22,700	COFFEY C. EVANS, JR.
	Utilization of suspended particulates			\$21,000
UNIVERSITY OF WASHINGTON	MARINE CHEMISTRY - OTHER	13 09/15/68	\$65,000	C. GRANT ALLAN
	Utilization of marine polymers			\$11,000
UNIVERSITY OF WASHINGTON	VEHICLES, VESSELS, AND PLATFORMS	21 01 02	\$26,000	GORDON S. GARY
	Investigation of performance of floating structures			\$25,000
UNIVERSITY OF WASHINGTON	COMMERCIAL FISHERIES - TECHNOLOGY	10 02/28/68	\$65,700	STANLEY B. MURPHY
	Estimation of fish stocks by echo sounding			\$12,100
UNIVERSITY OF WASHINGTON	COMMERCIAL FISHERIES - TECHNOLOGY	10 02/28/68	\$15,000	OLF A. WARTHEM
	Seafloor science and technology			\$9,000
UNIVERSITY OF WASHINGTON	SEAFLOOR SCIENCE AND TECHNOLOGY	14 09/15/68	\$51,000	GEORGE H. BRIGHT
	Optimal utilization concept			\$27,000
UNIVERSITY OF WASHINGTON	COASTAL ENVIRONMENT - SOCIAL SCIENCES	10 09/15/68	\$16,200	JAMES A. CRITCHFIELD
	Socio-economic, institutional, and legal considerations in the management of Puget Sound			\$1,000
UNIVERSITY OF WASHINGTON	COASTAL ENVIRONMENT - NATURAL SCIENCES AND ENGINEERING	19 02/28/68	\$13,000	ALYN C. BURBURY
	Marine environment of Puget Sound			\$10,000

** SEA GRANT PROJECT REPORT BY INSTITUTION **

WASHINGTON UNIV OF WASHINGTON ECOSYSTEMS APPROACH ECOLOGY AND DISTRIBUTION OF MUSSEL SOUND FISHES	50	07/01/71	912,500	ALLAN C. McLACY 87,500
UNIV OF WASHINGTON ENVIRONMENTAL SCIENCES - BIOLOGICAL PROCESSES BIOLOGICAL WASHINGTON MODEL FOR MUSSEL SOUND	47	09/15/68	919,000	DONALD F. HINTER 83,300
UNIV OF WASHINGTON ENVIRONMENTAL SCIENCES - BIOLOGICAL PROCESSES MADRYSH--A CONCEPT DIRECTED TOWARD A TOTAL SYSTEM QUANTY APPROACH TO M PAC COASTAL Z REOURCES	47	01/01/71	919,600	LEWIS J. BALFORD 952,400
UNIV OF WASHINGTON COURSE DEVELOPMENT - LAW OCEAN LAW	55	09/15/68	937,200	WILLIAM T. MURPHY 950,600
UNIV OF WASHINGTON COURSE DEVELOPMENT - SPACEON TECHNOLOGY NEW COURSES IN FISHERIES	54	07/20/69	94,900	G. IVOR JONES 83,000
UNIV OF WASHINGTON COURSE DEVELOPMENT - FISHERIES AQUATIC STOCK MANAGEMENT	59	07/20/68	99,900	OLE A. MATHISEN 96,400
UNIV OF WASHINGTON COURSE DEVELOPMENT - OCEAN ENGINEERING INTERDISCIPLINARY OCEAN ENGINEERING SYSTEMS	61	01/01/70	94,600	KARL WESPER 817,500
UNIV OF WASHINGTON COURSE DEVELOPMENT - OCEAN ENGINEERING PROGRAM IN OCEAN ENGINEERING	61	09/15/69	94,100	FUGENE P. RICHY 824,700
UNIV OF WASHINGTON COURSE DEVELOPMENT - OTHER NORTHWEST QUARTER	62	93 62	300	MORTON KRULL 84,000
UNIV OF WASHINGTON COURSE DEVELOPMENT - OTHER A PROGRAM IN MARINE AFFAIRS	62	01/01/71	934,000	EDWARD W. PARK, JR. 845,000
UNIV OF WASHINGTON COMMERCIAL DIVERS TRAINING UNEMPLOYED-TECHNICIAN PROGRAM AT MIELTINE COMMUNITY COLLEGE	63	93 62	924,000	JAMES G. SCOTT 869,000
UNIV OF WASHINGTON OCEANOGRAPHIC TECHNICIAN TRAINING OCEANOGRAPHIC AND MARINE BIOLOGY TECHNICIAN TRAINING PROGRAMS AT SHARP- LIMP COMMUNITY COLLEGE	64	09/15/68	811,500	JOHN G. SERRAVALLO 810,700
UNIV OF WASHINGTON COMMERCIAL FISHERIES TRAINING COMMERCIAL FISHERIES EDUCATION AND ADVISORY SERVICE AT CLOYSO PARK	66	09/15/68	819,600	GORDON L. QUICK 817,600
UNIV OF WASHINGTON COMMERCIAL FISHERIES TRAINING CRABS-MARLBOROUGH INVESTIGATIONS AT CRAYS MARLBOROUGH COLLEGE	66	01/01/71	87,100	JOHN M. SMITH 85,100

SEA GRANT PROJECT REPORT BY INSTITUTION **

UNIV OF WISCONSIN									
UNIV OF WISCONSIN	UNIV OF WISCONSIN	30	03 05	95,200	R A STUCKE	96,200			
COMMERCIAL FISHERIES - TECHNOLOGY	FOOD-PROCESSING OF UNDERUTILIZED GREAT LAKES FISH SPECIES								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	34	07 05	95,300	F WEGMANN				
PORTS HARBORS AND OFFSHORE TERMINALS	PORTS HARBORS AND OFFSHORE TERMINALS								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	36	07 05	95,200	C KARANT	900			
PORTS HARBORS AND OFFSHORE TERMINALS	PORTS HARBORS AND OFFSHORE TERMINALS								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	36	09/01/71	95,100	P HOWMEYER & T COFFIN	911,200			
PORTS HARBORS AND OFFSHORE TERMINALS	PORTS HARBORS AND OFFSHORE TERMINALS								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	36	07 05	949	WILLIAM DEEG	911,000			
PORTS HARBORS AND OFFSHORE TERMINALS	PORTS HARBORS AND OFFSHORE TERMINALS								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	36	07 05	916,000	F WEGMANN	900			
PORTS HARBORS AND OFFSHORE TERMINALS	PORTS HARBORS AND OFFSHORE TERMINALS								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	37	07 05	916,000	KAROL RAYE	900			
TRANSPORTATION SYSTEMS - OTHERS	TRANSPORTATION SYSTEMS - OTHERS								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	37	07 05	916,000	E SCHMEYER & M BONDRELL	900			
TRANSPORTATION SYSTEMS - OTHERS	TRANSPORTATION SYSTEMS - OTHERS								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	37	07 05	942,200	F SCHMEYER & M BONDRELL	900			
TRANSPORTATION SYSTEMS - OTHERS	TRANSPORTATION SYSTEMS - OTHERS								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	37	07 05	915,000	F DEEMOND & M GARVEY	900			
TRANSPORTATION SYSTEMS - OTHERS	TRANSPORTATION SYSTEMS - OTHERS								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	37	07 05	923,000	M A GARVEY	900			
TRANSPORTATION SYSTEMS - OTHERS	TRANSPORTATION SYSTEMS - OTHERS								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	37	07 05	919,000	F SCHMEYER	900			
TRANSPORTATION SYSTEMS - OTHERS	TRANSPORTATION SYSTEMS - OTHERS								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	36	07 05	99,000	WILLIAM DEEG	900			
COASTAL ZONE MGMT SOCIAL SCIENCES	COASTAL ZONE MGMT SOCIAL SCIENCES								
UNIV OF WISCONSIN	UNIV OF WISCONSIN	36	07 05	932,500	DAVID SANICKI	900			
COASTAL ZONE MGMT SOCIAL SCIENCES	COASTAL ZONE MGMT SOCIAL SCIENCES								

.. STATE GRANT SUBJECT REPORT BY INSTITUTION ..

UNIV OF MICHIGAN						
UNIV OF MICHIGAN	CRISTAL ZONE MGMT SOCIAL SCIENCES	3A	01 05	\$21,900	F. THERIAULT	000
	THE PUBLIC EDUCATION OF ENVIRONMENTAL ISSUES, RIGHTS AND OBLIGATIONS IN MICHIGAN					
UNIV OF MICHIGAN	CRISTAL ZONE MGMT SOCIAL SCIENCES	3B	01 05	\$2,200	J. STEINWART	000
	USE OF INTERACTIVE GAMES AS MEANS OF ATTEN PART IN THE PROG OF PLANNING POLICY FORMATION					
UNIV OF MICHIGAN	CRISTAL ZONE MGMT SOCIAL SCIENCES	3C	01 05	\$25,900	GEORGE BUNN & DONALD LARCE	000
	TRAVEL & NATIONAL MICHIGAN POLICY ON POWER PLANT SITING AND ELECTRICITY CONSUMPTION					
UNIV OF MICHIGAN	CRISTAL ZONE MGMT SOCIAL SCIENCES	3D	01 05	\$10,700	G. JARRELL VANOROUGH	000
	WATER RESOURCES POLICY AND POLICY - POLITICAL DIM OF WATER USE IN THE FOR OTHER MICHIGAN					
UNIV OF MICHIGAN	CRISTAL ZONE MGMT SOCIAL SCIENCES	3E	03 05	\$12,900	HALVOR KOLSHUS	000
	WATER QUALITY AND WATER QUALITY ON THE ECONOMY OF BROWN COUNTY, WISC					
UNIV OF MICHIGAN	CRISTAL ZONE MGMT SOCIAL SCIENCES	3F	03 05	\$25,000	Z. ZELE	000
	THE LEGAL ASPECTS OF PROTECTING THE SHORELANDS OF LAKE SUPERIOR					
UNIV OF MICHIGAN	CRISTAL ZONE MGMT SOCIAL SCIENCES	3G	03 05	\$10,000	J. WIERSMA & P. SAGER	000
	WATER QUALITY AND WATER QUALITY					
UNIV OF MICHIGAN	CRISTAL ZONE MGMT SOCIAL SCIENCES	3H	03 05	\$21,200	A. W. SPYTON	000
	COMMERCIAL STUDY OF THE WATER QUALITY OF WILSONS HARBOR AND ADJACENT LAKE MICHIGAN					
UNIV OF MICHIGAN	CRISTAL ZONE MGMT SOCIAL SCIENCES	3I	03 05	\$15,000	DAVID GUTCHIN	000
	TRAVEL STUDY FOR COMPLETE SUPPLY AND ANALYSIS OF WAT. HIGH FRESHWATER RAYS					
UNIV OF MICHIGAN	CRISTAL ZONE MGMT SOCIAL SCIENCES	3J	03 05	\$10,000	A. M. BEETON	000
	IDENTIFICATION AND EVALUATION OF SOURCES OF HYDROGRAPHIC DATA ON THE GREAT LAKES					
UNIV OF MICHIGAN	CRISTAL ZONE MGMT SOCIAL SCIENCES	3K	03 05	\$15,000	A. B. STECKEL	000
	ECOLOGICAL RELATIONSHIPS BETWEEN LAKE SUPERIOR AND ITS TRIBUTARY STREAMS					
UNIV OF MICHIGAN	ECOSYSTEMS RESEARCH	4A	03 05	\$900	E. M. GIBBIS	000
	ROLE OF NITROGEN-FIXING BLUE-GREEN ALGAE IN EUTROPHICATION					
UNIV OF MICHIGAN	ECOSYSTEMS RESEARCH	4B	03 05	\$11,100	WILLIAM STURLEY	000
	SYSTEM DYNAMICS AND PRODUCTIVITY IN THE FOR AND WOLF RIVERS					
UNIV OF MICHIGAN	ECOSYSTEMS RESEARCH	4C	03 05	\$15,300	E. M. GIBBIS	000
	FACTORS AFFECTING ENERGY FLUXES IN LAKE MICHIGAN					

UNIVERSITY	PROJECT NAME	DATE	AMOUNT	PI
UNIVERSITY OF MICHIGAN	CONSTITUENTS RESEARCH	60	911,100	DEWITT KEENEY
	STUDIES ON A NUMBER OF SPECIES OF FISHES IN GREEN BAY			9700
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	62	95,400	P. ELLESON
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			95,300
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	62	82,700	D. ARMSTRONG
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			81,100
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	62	97,300	C. PAGE LEE
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			97,200
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	63	817,400	C. STALLS
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			800
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	63	931,700	JOHN J. HANCOCK
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			89,000
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	63	917,100	A. MASLER, D. HERRMANN
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			811,500
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	63	94,000	THOMAS GREEN
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			93,500
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	64	82,000	C. PAGE LEE
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			81,200
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	64	87,000	C. PAGE LEE
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			87,000
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	64	87,000	ARTHUR MASLO
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			816,500
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	65	81,000	C. ENHARD STYER
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			810,300
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	65	82,000	JAMES P. ALLEN
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			86,700
UNIVERSITY OF MICHIGAN	POLLUTION PHYSICS	65	912,100	MARK MELANCON
	RESEARCH ON THE EFFECTS OF HEAVY METALS ON LAKE MICHIGAN			800

SEA GRANT PROJECT FUND BY INSTITUTION **

UNIVERSITY	PROJECT TITLE	DATE	AMOUNT	PI
UNIV OF WISCONSIN	STUDIES ON CHEMICAL DEGRADATION OF PCBs	03 05	\$1,700	PAUL R HOLY
UNIV OF WISCONSIN	ENVIRONMENTAL MONITORING - PHYSICAL PROCESSES	03 05	\$10,000	M J DAY
UNIV OF WISCONSIN	ENVIRONMENTAL MONITORING - PHYSICAL PROCESSES	03 05	\$20,200	MICHAEL LEAVITT
UNIV OF WISCONSIN	INTERACTIVE MODELING SYSTEM FOR COASTAL ZONE POLICY STUDIES	03 05	\$12,000	C W HAYMARK
UNIV OF WISCONSIN	ENVIRONMENTAL MONITORING - OTHER	03 05	\$14,500	R A RAGOTZKE
UNIV OF WISCONSIN	COASTAL ZONE POLICY STUDIES - OTHER	03 05	\$2,000	J LARSEN
UNIV OF WISCONSIN	ENVIRONMENTAL MONITORING - OTHER	03 05	\$200	LIMBA WEINER
UNIV OF WISCONSIN	ENVIRONMENTAL MONITORING - OTHER	03 05	\$1,500	S O MCGRATH
UNIV OF WISCONSIN	ENVIRONMENTAL MONITORING - OTHER	03 05	\$1,000	J R MOORE
UNIV OF WISCONSIN	ENVIRONMENTAL MONITORING - OTHER	03 05	\$2,000	SEA GRANT ADVISORY COMMITTEE
UNIV OF WISCONSIN	ENVIRONMENTAL MONITORING - OTHER	03 05	\$2,700	CHARLOTTE M DUMM
UNIV OF WISCONSIN	ENVIRONMENTAL MONITORING - OTHER	03 05	\$1,400	DAVID STUMPF
UNIV OF WISCONSIN	ENVIRONMENTAL MONITORING - OTHER	03 05	\$11,000	JOHN QUICKEY

.. SFA GRANT SUBJECT REPORT BY INSTITUTION ..

UNIV OF WISCONSIN EXTENSION AGENT SERVICES MAINT. RECREATION RESOURCES	71	07/01/70	929,200	03 95	ROBERT BITTON 900
UNIV OF WISCONSIN CONFERENCES, INSTITUTES, ETC. ADVISED SERVICES CONFERENCES & WORKSHOPS	74	06/01/68	912,000	03 95	GREGORY D WEDOFF, 909
UNIV OF WISCONSIN PUBLICATIONS, AUDIO VISUALS, ETC. SFA GRANT BY DONORS	74	01 95	92,000		MORIS FRANK 940
UNIV OF WISCONSIN PUBLICATIONS, AUDIO VISUALS, ETC. SFA GRANT COMMUNICATIONS	74	07/01/69	928,200	03 95	LINDA WEINER 966,200
UNIV OF WISCONSIN ADVISORY SERVICES - RIMEP ADVISORY SERVICES DIRECTOR'S OFFICE	77	06/01/68	950,000	03 95	C D WEDDEN, 900
UNIV OF WISCONSIN PROGRAM ADMINISTRATION PROGRAM ADMINISTRATION - WILBURGER	79	09/01/69	921,500	01 95	C MORTIMER 900
UNIV OF WISCONSIN PROGRAM ADMINISTRATION PROGRAM ADMINISTRATION - WADSWAN	79	08/01/68	916,000	03 95	R MACHITZKE 9120,100
UNIV OF WISCONSIN WFM APPLICATIONS DEVELOPMENT PROGRAM DEVELOPMENT	81	06/01/68	949,000	01 95	SFA GRANT ADVISORY COMMITTEE 922,500

AMERICAN SAMOA
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CONFIDENTIAL REPORTS DEVELOPMENT IN AMERICAN SAMOA

.. GFA GRANT PROJECT REPORT BY INSTITUTION ..

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[Additional Sea Grant Accomplishment Report By Classification
was received and placed in Committee Files.]

Mr. DOWNING. Our next witness is Dr. Edward S. Epstein, Associate Administrator for Environmental Monitoring and Prediction, NOAA. You may proceed, sir.

STATEMENT OF DR. EDWARD S. EPSTEIN, ASSOCIATE ADMINISTRATOR FOR ENVIRONMENTAL MONITORING AND PREDICTION, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Dr. EPSTEIN. Mr. Chairman, in my prepared statement I have reviewed current NOAA programs in environmental monitoring and prediction related to the ocean.

In the interest of time I request that it be included in the record and I will present now only a summary of our recent activities and accomplishments.

Mr. DOWNING. Without objection your statement will be made a part of the record.

[The prepared statement follows:]

STATEMENT OF DR. EDWARD S. EPSTEIN, ASSOCIATE ADMINISTRATOR FOR ENVIRONMENTAL MONITORING AND PREDICTION, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Mr. Chairman and members of the subcommittee, I welcome this opportunity to appear before you today to review NOAA's program in environmental monitoring and prediction. Processes in the atmosphere and oceans play an important role in the day-to-day conduct of our lives. For this reason, NOAA provides to the public a broad range of environmental monitoring and prediction services. Our purposes is threefold:

to protect life and property through the timely warning of impending natural disasters such as hurricanes, floods, and tsunamis.

to improve the efficiency of commerce, industry, and agriculture as well as our daily lives through routine forecasts of environmental conditions such as weather, sea conditions, and solar sunspot activity.

to maintain an awareness of the health of our environment through periodic assessments of the short and long-term effects of natural and man-made activities on physical processes such as climate.

It is becoming increasingly apparent and important that we must view the Earth as a complex, interacting system with each part affecting all others. We have long recognized the need to treat our global environment in such a comprehensive way. Mindful of societal needs, we are now putting together the necessary tools to accomplish our goals. As the oceans and atmosphere impact upon man, he in turn influences natural processes through his industrial and agricultural activities and demographic habits. These perspectives—the global nature of the environment and the close interdependencies of man with his environment—have guided the evolution of our programs.

There is continuing development of a host of mutually supportive techniques and technologies for monitoring the environment. NOAA relies on a wide variety of facilities, observational platforms, and sensor systems to carry out its monitoring program: land stations, ships, satellites, balloons, radars, and buoys. These are organized into various configurations to provide a complementary mix of observational data and information that can support appropriate warnings, forecasts, and assessments. Not only does this data and information base support our operational requirements, but it also supports basic and applied research programs to further understand fundamental processes and to develop new predictive capabilities.

NOAA works closely with other Federal agencies, such as the Department of Transportation, Department of Defense and Environmental Protection Agency (EPA), that are involved in monitoring and predicting environmental conditions to meet their mission needs. NOAA leads the interagency coordination of Federal atmospheric and oceanic environmental monitoring and prediction activities.

This coordination has resulted in the preparation of a number of national plans for coordinated Federal programs (for example, the Federal Plan for Natural Disaster Warning and Preparedness) to provide more cost-effective national monitoring and prediction efforts. Because many of the environmental monitoring and prediction problems are global in nature, NOAA has been working internationally to develop the World Weather Watch, the Integrated Global Ocean Station System and the EARTHWATCH concept of the UN Environmental Program.

Today I shall address primarily NOAA's environmental monitoring and prediction programs that have a major interrelationship with the oceans.

Our NOAA marine weather and ocean services programs involve the production of warnings and forecasts intended for safeguarding life and property, for increasing efficiency and effectiveness of operational activities in marine areas, and to support oceanic research. Our direct beneficiaries include shipping, petroleum and mining industries, fisheries, recreational activities, and coastal inhabitants.

The National Weather Service is responsible for specialized weather, storm surge, tsunami, ocean wave, and sea-ice warnings and forecasts along with other information essential to the conduct of effective marine operations and for protection of the boating public. During the past year our National Meteorological Center began issuing completely computerized wind wave and swell predictions for use as guidance by our Marine Forecast Units in preparing forecasts and warnings. Marine Forecast Units have been established at the Weather Service Forecast Offices in Anchorage, Washington, D.C., San Francisco, Honolulu, and Miami. They provide broad based products designed for the various activities within their assigned geographical areas. Later this year, the National Meteorological Center will initiate a sea surface temperature analysis program for both the Pacific and Atlantic.

For disseminating marine forecasts and warnings, we are expanding the number of VHF/FM stations along the coasts. In addition, we have initiated the broadcasting of advisories of storms at sea by means of National Bureau of Standard's time and frequency reference radio stations (WWV and WWVH) and the broadcast of weather and wave condition charts by facsimile from the Coast Guard Radio Station in San Francisco.

Much of the coastline of the United States, including that of the Great Lakes, lies exposed to the winds and waves of violent maritime storms, e.g., hurricanes on the Atlantic and Gulf coasts and extra-tropical cyclones on the Pacific. Prediction of these storms and their effects and the dissemination of public warnings have been one of the main responsibilities of NOAA and its predecessor organizations for more than a century. NOAA makes intensive use of the information that data buoys, satellites, and specially instrumented reconnaissance aircraft gather on off-shore weather conditions. Using large computers, these data and information are processed into timely forecasts of impending hurricanes and the resultant storm surge. NOAA can report measurable improvement in this vital warning service on three fronts:

Improved methods have reduced the average error in forecasting coastal storms, especially hurricanes.

Forecasting storm surge effects has been improved. We are now able to compute more accurately the effects of tides and winds in coastal basins to predict the depth of the storm surge. This predictive capability along with prior surveys of coastal areas provides local officials with estimates of possible flooding.

NOAA assistance in community preparedness is helping local officials to make stronger and more realistic plans for action when disaster threatens. New concepts such as vertical evacuation into the upper floors of high-rise structures instead of horizontal evacuation far inland over crowded, flood-prone highways are helping to reduce the toll of human and economic disruption that inevitably accompanies coastal storms.

Our work still has far to go. About three hurricanes out of ten, for instance, fail to behave according to our best understanding of the mechanisms at work. However, continuing improvements in data-gathering and data-handling techniques, together with improvements in the theory and practice of storm forecasting, will increase our capability to bring the public more accurate and more timely warnings. A new hurricane modelling effort is actively underway at the

National Meteorological Center, jointly with the National Hurricane Research Laboratory, to put these improvements into practice.

At the last oversight hearings, we cited difficulties we had encountered in our field research on the modification of hurricanes; namely, the low incidence of suitable hurricanes in the Atlantic test area and notification by the Department of Defense that they will only be able to participate in future STORMFURY experiments on a fully reimbursable basis, and then only if the necessary aircraft are available for nonmilitary use. These factors plus the age and increasing costs of maintaining our Research Flight Facility aircraft and instrumentation caused us to discontinue the field seeding phase of STORMFURY and seek a new approach to the project.

I am pleased to report that we have taken positive action during the past year to overcome these difficulties and now have firm plans to renew our STORMFURY field experiments in 1976. We plan at that time to conduct seeding experiments on typhoons in the western Pacific, operating out of Guam.

In FY 1974 we initiated a program to modernize the Research Flight Facility with the purchase of one new P3-D aircraft, components for a data system for the P3-D, and one Airborne Weather Reconnaissance System for the NOAA C-130. Simultaneously, two obsolete aircraft (one B-57 and one DC-6) were phased out after more than 15 years of service in hurricane penetrations and oceanic operations. Procurement of a second P3-D aircraft is planned in FY 1975.

A Project STORMFURY plan for Pacific operations is being coordinated with the National Aeronautics and Space Administration, the National Science Foundation, and the Department of Defense. This plan calls for the participation of the NASA CV990 aircraft and the NSF Electra which is assigned to the National Center for Atmospheric Research. NASA and NSF will be reimbursed by NOAA for the costs of deployment, spares, and operations. Department of Defense assistance in terms of logistics and facilities is being requested on a cost reimbursable basis. Assuming other agency approval, we plan to conduct the STORMFURY seeding experiment in the western Pacific during the 1976 and 1977 typhoon seasons, beginning in July 1976.

The interagency program in the Pacific offers a valuable opportunity for investigations into ocean dynamics and boundary layer meteorology under storm conditions. We anticipate that university groups will participate in these studies under NSF sponsorship. NASA is planning to test the instrument array being developed for the first oceanographic satellite—SEASAT-A—which is now scheduled to be in orbit by about 1979. These satellite sensors will produce data on sea state, sea surface temperature and topography, wave direction, and sea surface winds. The STORMFURY Program will provide an ideal opportunity to test these instruments on an aircraft platform under extreme sea surface conditions, and will permit comparison with dependable auxiliary measurements.

The Pacific has special appeal to the STORMFURY scientists because climatology shows that they can expect three times as many seedable storms in the Pacific as they can in the Atlantic. With this move, therefore, we expect to drastically reduce the duration of the experiment. Since the inception of STORMFURY in 1962, the Atlantic has yielded only three hurricanes that met the scientific and safety criteria for seeding. Of the two most recent such storms (Debbie in 1969 and Ginger in 1971) only Debbie satisfied the scientific criteria for the eyewall experiment, which is the primary or "core" experiment of the project. The results of the hurricane Debbie multiple seeding experiments conducted on 18 and 20 August 1969, were extremely encouraging in that decreases of 31 and 15 percent in the maximum wind velocity at 12,000 feet were observed on the respective days. Although not conclusive, time sequences of wind, radar, and other data strongly suggest that a modification to the hurricane had been achieved.

Our primary objective is to conduct ten to twelve eyewall modification experiments on Pacific typhoons during the summers of 1976 and 1977 to confirm the apparent success achieved in Debbie. In addition to the basic modification experiment, extensive measurements will be taken in seeded and unseeded typhoons to provide data essential to evaluating the results of seeding and for improving numerical models. Auxiliary typhoon and non-typhoon measurement programs are planned to ensure efficient utilization of STORMFURY resources.

Meanwhile, all phases of Project STORMFURY except the actual seeding of

hurricanes continue without change. An intensive program of storm modelling is being carried out to learn more about the structure and dynamics of hurricanes. Cloud physics data from tropical storms off the Florida coast will be collected from aircraft when available, as well as from radar and satellites, to support the modelling effort. Computer simulations of hurricane modification experiments will aid in the design and evaluation of future field experiments. Additional intensive efforts in analytic studies involving sea surface temperatures, air motions, and satellite-gathered cloud data will be carried out to develop a better understanding of storm structure and energetics and to provide information to the storm modelers.

While the U.S. has indeed been fortunate over the past 10 years in not having significant tsunamis hit our shores, I want to assure the Committee that NOAA has continued to maintain its capability for tsunami warnings. Through agreement with the Geological Survey, we are monitoring seismic activity continually for the first indications of potential tsunamigenic events; fortunately none has occurred recently with sufficient intensity or at places where these devastating phenomena are generated. Organizationally we have made one major change in this program by transferring the Tsunami Warning program from our National Ocean Survey to the National Weather Service. This now provides us with the opportunity of consolidating all of NOAA's environmental warning responsibilities into one major organization, and facilitates joint use of our communication facilities for disseminating these warnings to the public. Our observatory in Honolulu, in addition to being the national Tsunami Warning Center, also serves as the International Tsunami Warning Center for the entire Pacific Basin. For providing warnings in the Alaska area, NOAA also maintains a Regional Tsunami Warning Center at Palmer, Alaska.

Besides our warning function, NOAA has the responsibility for the International Tsunami Information Center and as such maintains a complete data set on tsunamis. A major element of our international role in tsunamis has been directed at providing the many developing nations of the Pacific basin assistance in the form of expert advice on the establishment and maintenance of national warning systems.

We are able to report encouraging progress with our environmental data buoy program over the past year. Although still in the engineering test and evaluation phase, our large moored data buoys have been located in the Gulfs of Alaska and Mexico and in the storm-ridden zone of the western Atlantic. During this phase, reliability of the systems has been improved and we have been able to get important operational data. From the successes realized with these test systems, we have progressed far enough to begin procurement of our first prototype operational buoys with sensors which will provide many of our needs. We believe environmental data buoys have a significant future role in marine monitoring, such as contributing to improved forecast and warning services and also research programs such as air-sea interaction studies. The advantages, disadvantages, and costs of buoys as a complimentary data collection system, will be evaluated before proceeding to the implementation of a full scale operational buoy system.

Besides the large moored data buoy effort, we have developed several other classes of buoys required by the research scientists. Of particular interest has been the development of a small expendable drifting buoy for use in experiments such as the First GARP Global Experiment. I will discuss more about these two major field experiments later. The U.S. and the NOAA Data Buoy Office in particular, have been in the forefront of the development of small drifting buoys, and the program is of considerable international interest. For example, during this past January a number of the small NOAA drifting buoys were tested in the southern polar oceans as part of a cooperative experiment with Australia and the USSR.

This is a convenient place to introduce a key satellite role in the acquisition of oceanic data, since these automated shipboard monitoring systems would communicate their data via geostationary satellites. NASA will launch SMS-A, the first of this series, later this spring. Eventually, NOAA will take over and operate two of these satellites which will be redesignated Geostationary Observational Environmental Satellites (GOES).

These new satellites will provide two very fundamental capabilities. They will provide data collection capabilities from remote platforms such as ships and buoys, and they will also provide nearly continuous viewing of most of North

America and the Atlantic and Pacific Oceans in both the visible and infrared parts of the spectrum. Among other applications, it is now possible with these images to determine winds over oceanic areas as never before possible. Such information will be of great value for preparing forecasts and warnings of environmental conditions to enhance the safety and efficiency of a wide variety of marine activities including transportation, off-shore drilling and mining, commercial fishing, and recreation. In addition to conventional cloud imagery, our polar-orbiting satellites now carry a vertical temperature profile radiometer that provides quantitative measurements of the vertical structure atmosphere over the ocean that heretofore were unavailable except in a very limited way from ship platforms. Based on information derived from the polar-orbiting satellites, charts of sea surface temperatures and sea ice distribution for use in shipping operations and by fisheries are now being produced for the global oceans.

In the area of new developments, preliminary results using ERTS-1 data indicate that ocean color distribution may prove useful in identifying and locating concentrations of biomass that may be related to the presence of commercially significant fisheries. NOAA has also been participating in the SEASAT-A program mentioned earlier which we feel will improve our ability to monitor and predict ocean phenomena from satellites. A particularly promising hope for SEASAT-A is the satellite-borne altimeter that would be capable of measuring sea level so precisely that much needed information on major currents of the ocean could be routinely available. Such a capability could provide a significant input to our ocean monitoring program, particularly in our efforts to preserve or enhance the quality of the ocean environment.

Remote sensing of the oceans need not be done only from satellites. Another very promising tool now being developed by our Environmental Research Laboratories is an over-the-horizon radar capable of sensing the sea state or roughness as determined by the heights of the largest waves present. When implemented, this technique will greatly improve our capability to provide real-time information on sea state conditions to help protect life and property and improve the efficiency of maritime operations.

By nature, many of our marine programs have international aspects and I would like to review several current cooperative efforts that are now planned or underway.

As part of the International Hydrological Decade, the United States and Canada have been joint participants in a comprehensive research project conducted on Lake Ontario and the Ontario Basin. The project, called the International Field Year for the Great Lakes, was designed to provide a scientific basis that will ultimately lead to improved management of the water quality and water quantity of the Great Lakes. Under NOAA's leadership, the U.S. contribution involves seven Federal departments as well as private institutions and universities.

An intensive data acquisition program that commenced in April 1972 was completed in April 1973. This program, using a wide array of platforms including ships, buoys, aircraft, and shore installations, amassed an extensive collection of environmental data totaling more than 100 million observations. This phase has been so successful that it will serve as a valuable model in studying other lakes or large inland water bodies.

With the field phases completed, the analysis and archival phases of the project have been set into motion. Preliminary analyses of the data indicate that the atmosphere plays a highly deterministic role in the development of circulatory and thermal patterns of Lake Ontario. These features are dominant in the transport and concentration of pollutants. Models are being developed using observed and inferred relationships among the physical, chemical and biological characteristics of the Lake to achieve a better understanding of the processes involved and as a result to achieve a capability to predict future states and to manage the important water resources of the Great Lakes.

An international program of even larger scope is about to begin. From June 17 to September 23, 1974, one-third of the earth's tropical belt will be under intensive observation in the largest and most complex international scientific experiment ever undertaken—the Global Atmospheric Research Program's (GARP) Atlantic Tropical Experiment (GATE). GARP is jointly coordinated by the World Meteorological Organization and the International Council of Scientific Unions, and GATE is the first major international field program. Coordination of United States participation in the GATE experiment is assigned to NOAA.

The central objectives of GATE are to study the structure and evolution of weather systems in the tropical eastern Atlantic and to assess the extent to which these tropical disturbances affect the circulation of the whole atmosphere. As these systems are closely coupled to related oceanic processes and circulation features, oceanographic studies are integral to the design of the experiment.

The oceanographic studies focus on two aspects with broad scientific and practical importance. The first is the interaction of the ocean's upper layers with the atmosphere especially as related to organized atmospheric convective systems that carry away heat and water from the ocean surface. The second focus of the oceanographic program is the complex equatorial current system, closely related to oceanic upwelling processes and to the atmosphere's intertropical convergence zone. Understanding of this major feature of oceanic circulation is vital to the development of models of the world ocean, as is understanding tropical convection to modeling the global atmosphere.

The GATE centers on an extensive observational program based on the augmented World Weather Watch network of continental and island-based weather stations, specially instrumented ships and aircraft supplemented by operational polar-orbiting and geostationary satellites, and buoys.

The broad area of the experiment includes the entire tropical Atlantic and the adjacent continental regions. Thirteen nations, including Brazil, Canada, the Federal Republic of Germany, the German Democratic Republic, Finland, France, Mexico, the Netherlands, Portugal, Senegal, U.K., U.S., and U.S.S.R., have made commitments of substantial contributions to the experiment. The experiment is planned to involve some 37 ships and a dozen instrumented aircraft. The U.S. will participate with at least 8 ships—either equipped with sophisticated meteorological instrumentation to participate in the fixed network or involved in the oceanographic studies—instrumented aircraft, polar-orbiting and geostationary satellites, and a variety of buoys.

The objectives of FGGE can be summarized very simply, but they are ambitious. This research program is directed toward developing better computer models of the atmosphere and assessing the ultimate limit of the predictability of weather. The object is to obtain a set of global data of such quality and density that our modeling efforts will have a realistic yardstick of their performance and development.

The data collection phase of FGGE is presently scheduled to occur during 1978. It will involve the basic World Weather Watch observing system of roughly 4,800 land-based weather stations as well as geostationary and polar-orbiting meteorological satellites. An estimated 300 drifting buoys are being considered as one of several special-observing systems needed to supplement the basic network. As in GATE, oceanographic studies will be required to meet the objectives of FGGE and planning for these studies has already begun internationally.

It has become increasingly apparent that many of our more pressing environmental problems are global in nature and require global monitoring, predictions, and assessments to be dealt with properly. This need for a new global perspective has been recognized internationally with the establishment of the UN Environment Program which, as you will recall, was a direct result of the UN Conference on the Human Environment held in Stockholm. A central aspect of the UN Environment Program is EARTHWATCH—a comprehensive coordinated effort in global environmental assessment that includes monitoring, research, and information exchange to evaluate critical global problems such as climate change, marine pollution, land use practices, and natural disasters.

Just recently, an intergovernmental meeting was held in Nairobi, Kenya, headquarters of the UN Environment Program, to develop the framework for a Global Environment Monitoring System—or GEMS—as part of EARTHWATCH. NOAA played a central role in developing the U.S. background paper for this meeting and Dr. White led the U.S. delegation. GEMS will be built upon existing national and international programs and facilities and will include developing and expanding global capabilities for (1) the surveillance of human health, natural disasters, and food contamination, (2) the assessment of man's impact on climate, the oceans, biological systems, and ecosystem stability and modification, and (3) an evaluation of the impact of land-use practices.

NOAA expects to be directly involved in the evolution of this global environmental monitoring system. One area of particular interest and activity involves monitoring man's impact on weather and climate. There is mounting concern that the byproducts of man's activities—particularly energy utilization and industrial processes—may interfere with natural atmospheric processes and bring

about major changes in climatic conditions. NOAA has been operating an atmospheric baseline monitoring station at Mauna Loa, Hawaii since 1956. Observations taken over an extended period at this station documented the trend of increasing background carbon dioxide concentrations that may influence world temperature patterns.

NOAA has also established atmospheric baseline stations at Pt. Barrow, Alaska, and the South Pole and is in the process of establishing one at American Samoa as part of its Global Monitoring for Climate Change Program. This widely-spaced network of four stations will be representative of background conditions, and will assure broad latitudinal coverage within the global atmospheric circulation pattern. NOAA plans to implement a full monitoring program at all of these stations. Measurements will include, in addition to carbon dioxide, other trace gases, suspended particulate matter, and selected atmospheric pollutants. I should note here that NOAA's atmospheric baseline stations are part of a developing international network under the auspices of the World Meteorological Organization. In addition to our four stations, some nine other countries have indicated their intention to establish a total of 18 baseline stations which will be an important step in providing effective global coverage.

In summary, we are making steady progress toward evolving a coordinated ocean monitoring and prediction program and expanding our marine services. Many of our recent advances have involved the application of new technologies such as satellites and data buoys and I am confident that further advances will be forthcoming, particularly in the area of remote sensing of oceanic parameters and environmental pollutants. As we go forward with the full cooperation of all the Federal agencies, we shall continue to expand our monitoring and prediction capabilities through both new development and expanded application to better forecast marine events and manage and conserve our ocean resources.

This concludes my prepared testimony. I will be happy to answer any questions.

Dr. ERSTEIN. NOAA programs in environmental monitoring and prediction underpin one of our basic mission responsibilities to provide warning, forecasting, and assessment services to numerous categories of users.

With regard to the oceans, users include those involved in shipping, offshore petroleum and mining industries, fisheries, and marine recreational activities, as well as the general public, particularly coastal inhabitants. These services are directed toward the protection of life and property, the improvement in planning and management efficiency, and the enhancement of our environment.

In addition to our operational requirements, the observations from our monitoring systems also support research efforts to better understand the environment and improve our predictive capabilities.

To handle the large scale phenomena of the air and [atmosphere,] oceans, [and land,] such as weather systems, tsunamis, and ocean currents, we view our monitoring program in a global context. We have been active in numerous international operational and research programs so that we may accomplish our goals without relying exclusively on our own efforts.

Also, we have evolved—and continue to evolve—a broad range of observational platform and environmental sensor capabilities to allow optimum geographical coverage and frequency of observations.

This complex mix of techniques and technologies allows us to observe not only large scale events in a synoptic manner, but also the interaction among different parts of the environment. In this way we can evaluate both environmental events that may affect man and the impact of man's activities on environmental processes.

As you are, of course, aware, NOAA programs in ocean-related environmental monitoring and prediction are only a portion of the larger Federal effort, and NOAA works closely with such agencies as

the Department of Defense, the Department of Transportation, and the Environmental Protection Agency in carrying out its mission responsibilities.

NOAA leads the interagency coordination of Federal oceanic and atmospheric monitoring and prediction activities which include the preparation of a number of coordinated Federal plans.

NOAA utilizes a network of satellites, coastal observing stations, data buoys, and cooperative voluntary merchant ships to provide routine observations for the preparation of specialized weather, storm surge, ocean wave, and sea-ice warnings and forecasts.

New computerized methods at our National Meteorological Center will improve the ability of our Marine Forecast Unit to predict wind waves and ocean swell. Marine Forecast Units have been established in Anchorage, Washington, Honolulu, and Miami.

Later this year, the National Meteorological Center will also initiate a sea surface temperature analysis program for the Pacific and Atlantic. To improve the timely dissemination of our products, we are expanding our broadcasting capabilities by establishing additional stations and through the use of other specialized radio and facsimile networks.

Hurricanes and resulting storm surges along our coast lines are a particularly important aspect of our marine monitoring and prediction program. As developing hurricanes are detected, an accelerated monitoring program is initiated involving satellites, radars, data buoys, and specially instrumented reconnaissance aircraft.

The data from these observing systems are monitored continuously and processed with the help of computer models to provide systematically updated forecasts of the storm track, intensity and storm surge.

Via direct radio broadcasts, NOAA Weather Wire links to the media, and direct phone and teletype communication to local authorities, we get this information out to where it can do the most good.

Although there is still much room for improvement, we can report significant advances in forecasting where a hurricane will hit the coast and the resulting storm surge effects. We have also increased our efforts in assisting local communities prepare adequate contingency plans to reduce the toll of human lives and economic disruption.

During the past year, steps were taken to prepare for a renewed field research program—STORMFURY—on the modification of hurricanes. We are now carrying out an intensive program of storm modeling to better understand hurricane structure and dynamics, and in fiscal year 1974 we initiated a program to modernize NOAA's Research Flight Facility.

Working with NASA, NSF, and DOD, we plan to resume STORMFURY field operations in 1976 with seeding experiments in the Western Pacific.

In addition to ocean weather and sea conditions, NOAA also has responsibility for monitoring the occurrence of seismic sea waves—or tsunamis—and issuing timely warnings. The hub of our national Tsunami Warning Program, which is now under the auspices of the National Weather Service, is the Tsunami Warning Center in Honolulu which also serves as the international center serving the entire Pacific basin.

NOAA programs in platform and sensor development to improve our technological capabilities have made encouraging progress. Within the environmental data buoy program, our large moored data buoys are undergoing engineering tests and evaluation in the Gulfs of Alaska and Mexico and the Western Atlantic.

In addition, we have developed several other classes of buoys for research application, particularly a small expendable drifting buoy which shows considerable promise. We are convinced that these data buoys have a significant future role in marine monitoring to support both operational forecasting and warnings as well as research.

Satellites are playing an increasingly important role in the acquisition of oceanic data. New and improved satellites and sensor systems promise to further extend our capabilities. Our polar-orbiting satellites now provide cloud imagery, vertical temperature profiles of the atmosphere, sea surface temperature, and sea-ice distribution for forecast preparations as well as for specialized uses by shipping and fisheries interests.

A significant advance in our satellite network will be the Geostationary Observational Environmental Satellite, or GOES, which will be launched by NASA later this spring under the designation SMS-A. We intend to operate a system of two of these GOES satellites. They will provide not only nearly continuous—day and night—viewing of North America and the adjacent oceans, but will also have the ability to relay data from remote surface platforms such as ships and buoys to processing facilities.

We have already begun a cooperative program with the Maritime Administration to develop automated shipboard monitoring systems for selected ships of opportunity that will utilize the GOES data collection capabilities.

As Dr. White indicated, we have also been working with NASA on program development for an ocean dynamics satellite—SEASAT-A. A major element in the earlier cooperation with NASA involved the loan of Dr. John Apel, Director of our Ocean Remote Sensing Laboratory, as temporary SEASAT-A Project Director.

Dr. Apel continues to head NASA's User Working Group for SEASAT. The potential benefits of SEASAT-A to NOAA programs in environmental monitoring and prediction are significant indeed, and we will continue to provide support to NASA as the program develops.

In the meantime, we will be watching the program to determine future impacts on our operational ocean monitoring program. Specifically, SEASAT will be an invaluable tool for the synoptic monitoring and prediction of transient phenomena on the ocean surface such as wave heights and directions, surface winds, temperature, and storm surges, with an emphasis on identifying marine hazards. It will also play a significant role in our developing and validating means for predicting the general ocean circulation, surface currents, and their transports of mass, heat, and nutrients.

Another remote sensing tool under development at our Environmental Research Laboratories is an over-the-horizon radar capable of sensing wave and swell conditions at great distances. When implemented, this technique will greatly improve our monitoring capabilities in support of sea state forecasts.

I should mention several international efforts that are planned or underway under NOAA's leadership that support our environmental and monitoring prediction programs. The data acquisition phase of the International Field Year for the Great Lakes—part of the International Hydrological Decade—was completed in April 1973 and analyses and archival activities are now underway.

This joint United States-Canadian project was conducted on the Lake Ontario Basin and involved a wide array of observation platforms and techniques. Initial results indicate that the atmosphere plays a highly deterministic role in the circulation and temperature structure of Lake Ontario.

Modeling efforts are now underway incorporating data on the physical, chemical, and biological characteristics of the Lake. We anticipate a significant increase in our understanding of the complex interrelationships that exist in inland lakes and that this will contribute to improved management of water quality and quantity.

Indeed, some of the early results of IFYGL will be presented just this next week at a special session of the 55th annual meeting of the American Geophysical Union.

An international program of larger scope than IFYGL is the GARP Atlantic Tropical Experiment (or GATE) which will be initiated this early summer with intensive observations that will cover one-third of the earth's tropical belt.

Oceanographic studies are an integral part of GATE which will focus on the structure, evolution, and extra-tropical significance of weather systems in the tropical eastern Atlantic. GATE will involve some 37 ships and a dozen instrumented aircraft. Altogether 13 nations are making significant contributions.

The United States will participate with eight ships, several aircraft, satellites, and a variety of ocean buoys. We are looking forward to a significant increase in our knowledge of weather phenomena in an area where many of our more devastating hurricanes have evolved.

A major new thrust to tie together existing international environmental efforts in a coordinated multidisciplinary framework is the UN Environment Program and a central part of this program is EARTH-WATCH—a comprehensive initiative in global assessment. NOAA has been an active participant in the development of the UN Environment Program and the EARTHWATCH concept and will continue to contribute to its effective implementation.

Of particular interest is the design, development and implementation of a Global Environmental Monitoring System (GEMS) concerning which the Governing Council of the UN Environment Program earlier this month decided to continue its development and to begin its implementation.

An important element of GEMS is the proposed network of atmospheric baseline monitoring stations of which NOAA maintains the only currently operational facilities at Mauna Loa, Hawaii; Point Barrow, Alaska, and the South Pole.

In addition, we are establishing a fourth baseline station at American Samoa. Observations at Mauna Loa have already indicated a trend of increasing carbon dioxide concentration which may influence the global climate. This developing network underpins our capability to

assess long-term trends in the environment and the global transport of pollutants both through the atmosphere and into the oceans.

In closing, I feel that we have made important advances in pulling together a coordinated ocean monitoring and prediction program that is responsible to our national needs.

I hope that we will be able to make further progress in the future.

Mr. DOWNING. Thank you.

Our next witness this morning is Mr. Robert W. Knecht, Director, Office of Coastal Environment, NOAA.

STATEMENT OF ROBERT W. KNECHT, DIRECTOR, OFFICE OF COASTAL ENVIRONMENT, NOAA

Mr. KNECHT. I would like to follow suit and submit the full statement for the record, and I will simply highlight a few points.

Mr. DOWNING. The entire statement will be made a part of the record.

[The statement follows:]

STATEMENT BY ROBERT W. KNECHT, DIRECTOR, OFFICE OF COASTAL ENVIRONMENT, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Mr. Chairman and members of the subcommittee, it is a pleasure to appear before you for the purpose of giving you a progress report on NOAA's implementation of the Coastal Zone Management Act.

This Act, passed in October of 1972, was truly landmark legislation. The legislation authorizes, for the first time, a series of Federal grants-in-aid to assist States in developing and implementing rational management programs for their valuable coastal areas.

In August of 1973, the Administration amended its FY 1974 budget to Congress to request funds for the implementation of the legislation. The Congress in December of 1973, appropriated \$12 million for this purpose. It was decided to allocate the funding in the following manner:

\$7.2 million for development grants to the States.

\$4.0 million for acquisition, maintenance and operation of estuarine sanctuaries, and

\$0.8 million for the administration of the program.

Our report to you today is timely in view of the fact that the first three grants to coastal States were awarded last week.

My discussion of the coastal zone management program will have three parts: (1) development of the required policy and procedural framework, (2) development of the grant programs, and (3) supporting activities.

DEVELOPMENT OF POLICY AND PROCEDURAL FRAMEWORK

Immediately after passage of the legislation, NOAA organized a coastal zone management task force to commence planning for its implementation. The first job of the task force was to advise State governments concerning the procedures to be followed under the Act. Specific rules and regulations acquainting States with the nature of the grant-in-aid programs available under the Act were needed as guidelines. These were for management program development grants (Section 305), for administrative grants (Section 306), and for estuarine sanctuary grants (Section 312). An early decision was made within NOAA to employ as open a process as possible in the development of these guidelines. A substantial number of State and local government officials, representatives from other Federal agencies, and representatives of private sector groups were included in discussion sessions even before the first drafts of these guidelines were prepared.

Management program development guidelines were issued in draft form on June 13, 1973 and in final form on November 29, 1973 in the FEDERAL REGISTER. The procedural preparations to begin this grant program were complete with the issuance of a grants handbook to States on December 21, 1973.

After an extensive study of related Federal programs, estuarine sanctuary guidelines were prepared and published in draft form in the FEDERAL REGISTER on March 8, 1974. Final publication is due in May of 1974. As you know, these grants to coastal States will assist them in the acquisition, development, and operation of estuarine sanctuaries for the purpose of creating "natural field laboratories" to provide data and information vital to the coastal zone management programs to the States. The criteria to be used in selecting estuarine sanctuaries will be based on their ecological characteristics, size and selection of boundaries, cost, enhancement of noncompetitive uses, proximity and access to existing research facilities, availability of suitable alternative sites already protected, conflict with existing or potential competing uses, and compatibility with existing or proposed land use and water use in the contiguous areas. Sites selected as sanctuaries will reflect both regional differentiations and a variety of ecosystems in an effort to encompass all significant variations found in the coastal areas of the United States. It is estimated that at least 15 sanctuaries will be needed to complete such a "national" inventory.

Guidelines for grants to be given under Section 306, administrative grants, are now being drafted and are scheduled for publication in May. These guidelines will include both the criteria to be used by the Secretary of Commerce in approving a State's proposed management program and the procedures to be used by the State in applying for grants. The approval criteria will speak to such key issues as the extent of the inland boundary of a State's proposed coastal zone for management purposes and the adequacy of the process adopted by the State as a part of its management program to consider the national interest involved in the siting of facilities designed to meet more than local needs.

STATUS OF GRANTS PROGRAMS

Management Program Development Grants.—As mentioned above, the first three program development grants were awarded to the States of Rhode Island, Maine, and Oregon on March 13, 1974. Partial or complete applications are now on hand from an additional eight States. Thirty of the thirty-four coastal States (as defined in the Act) have formally declared in writing their intention to apply for program development grants during FY 1974. Only American Samoa has indicated that they definitely do not intend to apply indicating that they believe their HUD 701 funding to be sufficient for the purpose.

Estuarine Sanctuary Grants.—First draft application for an estuarine sanctuary grant was received in early March from the State of Oregon. An additional 11 States have indicated their intention to submit formal grant applications within the next 12 months.

Administrative Grants.—No administrative grants are expected to be given in FY 1974 since no State has a management program ready to submit for Federal approval. In FY 1975, however, it is anticipated that four to six applications for administrative grants subsequent to approval of the management programs involved will be received. Of these, it is likely that two to three of them will involve the entire coastal zone of the given States and the remaining two or three will pertain to the geographically segmented portions of a State's coastal zone proposed for early management program approval.

SUPPORTING ACTIVITIES

Program Staffing.—The program staffing has progressed very well. It is anticipated that hiring for State and regional coordination, grants management, sanctuaries, technical support, and program management, will be completed within about 45 days.

Technical Support for States.—(a) *Management Program Development Guidebook.*—The Coastal Zone Management Institute is in the final editing stage of a document they have prepared for NOAA, which describes in considerable detail, the alternatives and options open to States as they confront the specific management program requirements outlined in the Act. The Guidebook will be available to States in May of 1974.

(b) *Coastal Ecology Handbook.*—The Conservation Foundation has completed a comprehensive handbook describing the principal natural processes active in the coastal zone. Also included are recommendations as to appropriate development approaches for sensitive portions of our coastal areas. This document should also be available to States in May.

(c) *Sanctuaries Study*.—The Virginia Institute of Marine Sciences has completed an exhaustive study of the estuarine sanctuary provisions of the Coastal Zone Management Act and the marine sanctuary provisions of the Marine Protection, Research, and Sanctuaries Act of 1972. Included in the study was a review of the legislative history, an analysis of already existing related programs at the Federal and State levels, and recommendations as to the options open to NOAA in administering these two new efforts. A national workshop was held in November of 1973 to obtain the widest possible spectrum of views concerning these programs. The information coming out of the study has been of direct and immediate value in the preparation of draft guidelines for these sanctuary programs which were published in the FEDERAL REGISTER in March of 1974.

Coastal Zone Management Conference.—(a) In December of 1973 and January of 1974, NOAA organized a series of regional discussions at five coastal locations around the country to hear views and comments on its proposed approach to develop the criteria that would be used by the Secretary of Commerce in approving State management programs. These forums were of particular value in widening the circle of those familiar with the Coastal Zone Management Act and its intent.

(b) NOAA has also sponsored two national coastal zone management conferences. The first was held in Annapolis in June of 1973 and involved principally State officials who were directly involved in developing State coastal zone management programs. The second national Coastal Zone Management Conference was held in Charleston, South Carolina in March 1974. The objective of this Conference was to elicit a wide range of views concerning the nature of "the national interest" in coastal decision-making. Prominent leaders from both the public and private sectors presented their views on this subject to an audience of over 400.

Coastal Zone Information Center.—A coastal zone information center is being developed to serve as a clearinghouse for coastal zone management information and to serve both State and Federal needs. Several thousand key coastal zone management publications have already been assembled and over 175 periodicals of one type or another are now being received.

Briefings.—As the coastal zone management program becomes operational, the program of regular briefings to appropriate groups is being instituted. Groups to be included are the public interest groups (including the National Association of Counties, National League of Cities, and the National Governors Conference), interested congressional staffs and members, appropriate environmental groups, coastal zone user groups such as those involved in electrical utilities and marine recreation, Federal organizations such as the Federal Regional Councils, and the River Basin Commissions.

SUMMARY

In conclusion, Mr. Chairman, we believe that the coastal zone management program is now well launched. We continue to be impressed by the enthusiasm with which State Governments are approaching this program. Clearly, while improved coastal zone management was highly desirable in 1972 when the Act was passed, it has become absolutely essential in 1974. The increased pressures on our nation's coastal zones, especially those associated with energy-related problems, demand the adoption of more rational coastal decision-making processes at both the State and Federal levels.

This concludes my prepared testimony. I shall be happy to answer any questions.

Mr. KNECHT. I would like to speak to three points this morning.

First, give you a status report on the guidelines and regulations we are preparing to implement the Coastal Zone Management Act.

Secondly, talk briefly concerning the status of grants to states under the Coastal Zone Management Program.

And, thirdly, mention a few supporting activities we have undertaken in the last year.

First, with regard to the status of guidelines and regulations.

On November 29, we published in the Federal Register the regulations necessary for the states to apply for the first kind of grants authorized under the Act, grants to assist states in developing management programs for their coastal areas.

On March 7th, we published guidelines describing estuarine sanctuary provisions of the program.

On March 19th, we published guidelines in the Marine Sanctuary Program authorized by the ocean dumping legislation.

The final set of guidelines and regulations needed to implement fully the Coastal Zone Act are needed in connection with administrative grants and will be published in draft form in May of this year. That is to say, in two months.

That will complete the development of regulatory and procedural framework.

Concerning the grants to States, the first three grants, as Dr. White mentioned, to assist in development management programs were let approximately 2 weeks ago. Those grants went to the States of Rhode Island, Maine and Oregon.

It is interesting to note that in each case the states had begun development of coastal zone management programs under their own momentum, so to speak, but the Federal funding will be crucial in accelerating state efforts.

In the case of Oregon, for example, they expect to complete and submit a management program that, hopefully, will be federally approvable within 12 months.

In the case of Maine, their program should be submitted for Federal approval in 18 months.

And in the case of Rhode Island, a 24-month period will be required.

You remember the Act authorizes up to 36 months for this purpose. We are pleased that we can accelerate ongoing efforts with these first three grants.

We have in our offices now three additional grant applications from the States of Washington, Michigan and South Carolina. Those will be processed and, I hope, approved in the next several weeks.

In addition, of the remaining 24 coastal States, 22 have indicated in writing that they are now working on applications for grants yet this fiscal year. We expect 28 of the 30 coastal States to be in the program by the end of the fiscal year.

I am also happy to report that we already have two draft application for estuarine sanctuary grants under the program from the States of Oregon and New York. We are hopeful we can let one or possibly both of these before the end of this fiscal year to initiate that phase of the program.

Eleven other coastal States have indicated that they expect to apply for estuarine sanctuary grants during fiscal year 1975.

So much for the grants phase of the program.

Briefly, then, on a few of the supporting activities.

We have established the Advisory Committee called for under the legislation, and that committee has met twice, first in November of last year, and most recently in February of this year. The next meeting is set for late June or early July in the Great Lakes area. That committee is now at work considering the policy issues involved in this program.

We have held two national conferences on coastal zone management. The most recent one was in Charleston 2 weeks ago, and two members of your staff were in attendance at that meeting. We think it was a successful meeting, raising the visibility of coastal zone management

as an important national issue and beginning some important discussions that have to take place among various interests and sectors in this program.

We are in the process of completing three handbooks that will provide technical assistance to States as they begin the process of developing CZM programs.

Last, but not least, we are attempting to better focus ongoing NOAA programs, such as the sea grant program and the national marine fisheries programs, toward the needs of coastal States as they begin to develop coastal zone management programs.

We have initiated a coastal mapping study which will identify coastal mapping needs of the coastal States so we can insure NOAA's efforts in this area are as supportive as possible of State needs.

I think that concludes my remarks.

We believe the coastal zone management program is off to a good start. We are very enthusiastic about it, and we are very pleased to find that the coastal States are equally enthusiastic.

I will be happy to answer any questions.

Mr. DOWNING. Thank you.

Dr. White, your agency has been in existence now for more than 3 years. I think you have achieved significant progress in trying to arrive at a true national ocean program, despite obstacles in the way of funding. And I think you are doing the job that Congress intended this agency to do.

I want to congratulate you on that.

Also I thought this summary this morning was well done and well presented.

Mr. ROGERS.

Mr. ROGERS. Thank you, Mr. Chairman.

I share the chairman's high regard for the Administrator's able work and that of his associates here today.

We realize the constraints under which you are operating often determine the response to the problems. I have just a few questions.

Mr. WALLACE, how long did the deepwater port study take?

I believe you mention it on page 13, a deepwater port study.

Mr. WALLACE. Mr. Rogers, this has been a study which has been carried on by the Council on Environmental Quality. The studies fundamentally have already been done through our sea grant program, and I believe that the institutions that carried these out were Texas A. & M. and—Bob, can you help me out?

Dr. ABEL. Louisiana State, MIT, and Delaware.

Mr. WALLACE. These reports have been published.

Mr. ROGERS. I think it would be well for the committee to have copies of the reports. (Copies of reports are in committee files.)

Let me ask you, on page 4, you mention New York Bight. This is a current dump site, is it not, for New York?

Mr. WALLACE. Yes, the current dump site is located in the apex of New York Bight. It is being used by the city of New York, Nassau County, Long Island, and I believe, Westchester County, N.Y.

Mr. ROGERS. I notice you have been able to advise EPA on the status of the spread of sludge, possible alternative dump site.

What was that advice?

Is the sludge spreading?

Mr. WALLACE. I think the answer to the question is yes, the sludge has been spreading from the area which has been designated as a dump site. There was a major concern a few months ago that this sludge was actually working onto the beaches on Long Island and in New Jersey. However, on a very close look at this by our scientists working in the area, I think it is clear at this point that the sludge from the dump site itself has not, in fact, actually impacted directly upon the beaches. However, it is perfectly apparent that there has been spreading of the sludge from the dump site.

Mr. ROGERS. What is your projection as to how long it will take before that sludge reaches the beaches or affects them adversely?

Mr. WALLACE. This is a very difficult question to answer.

It would appear at this moment that this is not an imminent danger, although many people are concerned about it. We are looking at this problem, the rate of movement, right now. I have to admit that our studies have only been carried on for less than a year so that getting a precise fix on this rate is somewhat difficult at this moment.

So it is difficult for me to actually predict the time. Whether it would even happen at all is a question that is open because there is a complex system of currents and tides in the area which might very well result in the sludge not reaching the beaches under any circumstances. I do not want to be held to that, however.

Mr. ROGERS. Are they continuing to dump?

Mr. WALLACE. Yes; dumping is continuing at the present time.

Mr. ROGERS. Do you have any authority to prevent that dumping or to advise that dumping should not take place?

Mr. WALLACE. We do not have any authority to prohibit the dumping. The agency responsible for this is the Environmental Protection Agency. We have been in constant consultation with them about these particular matters.

Mr. ROGERS. What is your advice?

Is your advice that dumping be continued?

Mr. WALLACE. Our advice is that it would be quite dangerous to remove the dump site now. We do not have sufficient environmental baseline data on other possible site locations with which to evaluate what the future impact might be at those locations.

Mr. ROGERS. Is there any marine life at all in this area where they dump?

Mr. WALLACE. The life has changed from the original species that existed there. There are organisms which will live in this altered environment. But the species that we consider normal for the area, generally speaking, are not present precisely in the dump area.

Mr. ROGERS. Is this, in effect, considered a dead area?

Mr. WALLACE. Many people speak of it in that way. Normal shellfish which would live on the bottom no longer exist there. Fish do move in and out of the area but do not, generally speaking, populate the area.

Mr. ROGERS. For the most part, it is dead then?

Mr. WALLACE. It is not supporting a living organism in the context that we know about.

We are talking about a complex situation. One of the things we are talking about is the nitrates, phosphates, nutrients which are also involved in this sludge. These components are being added to the environment. Generally speaking, I think there is no question about it, this has deteriorated in a major way.

Mr. ROGERS. Should some alternative means of disposal of the sludge be undertaken?

Mr. WALLACE. Mr. Rogers, I think we have to look at all the possible alternatives, not only disposal at sea, but the possibility of changing the complexion of this sludge so that it can be utilized elsewhere ultimately, hopefully, and thus we will not have to dump it at sea.

It is a constant and continuing kind of thing. We have to look at all the possible alternatives, land disposal, et cetera.

Mr. ROGERS. I know we should. That is what I am asking you.

Should we stop it and do something else, or should we continue to dump?

Mr. WALLACE. I believe that it is impossible to stop the disposal of the sludge.

Mr. ROGERS. Why?

Mr. WALLACE. Because it is being produced in hundreds of thousands of tons per day, and it has to be disposed of in one way or another.

Mr. ROGERS. Do we have technology currently available to dispose of it in other ways, or would you know?

Mr. WALLACE. I am afraid I cannot be directly responsive to that question.

Mr. ROGERS. We will take that up with EPA.

If dumping in the sea is killing marine life, I think we ought to stop it. In fact, I think that was the thinking of this committee some years ago, and we are still studying it. It is frustrating sometimes, as I am sure it is with you, too.

Let me ask you this now then on sea grant colleges, Mr. Abel.

How many public and private colleges and universities have applied for sea grant?

Dr. ABEL. In the 7 years of our existence, Mr. Rogers, it is probably close to 700 at this point.

Mr. ROGERS. How many in 1973 and 1974, if you recall?

Dr. ABEL. Yes; we received very few applications in 1973 and 1974. We advised through our association that we really were not in a position to be making grants.

Mr. ROGERS. Why, because of funding?

Dr. ABEL. Yes, sir.

Mr. ROGERS. How much of your money is taken up with ongoing grants that have been previously approved?

Dr. ABEL. All of our resources this past year, with the exception of the grants I just enunciated, that is, international study and study concerning balance of trade technologies we used in ongoing grants in an institutional way. That is, there were several grants that were terminated through success or some other reason, but the same institutions were then able to use people to reverse the going directions.

Mr. ROGERS. How many new grants were you able to make in 1973, and how many will you be able to make in 1974?

Dr. ABEL. During this present fiscal year, the only two grants we will make are the two I have just cited. The balance of trade technology and the international study grant.

Mr. ROGERS. What is the extent of the funding in it?

Dr. ABEL. The international study grant, as prescribed in our last year's authorization, entitled us to spend \$300,000.

The balance-of-payments technology study is presently requested at \$19,000. I do not really know what the final sum will be on the international study because it is being subgranted out from MIT to other institutions, and the last of the requests have not been received yet.

Mr. ROGERS. So, in effect, you are just doing two new studies?

Dr. ABEL. Two new grantees. They will be additional studies within the grantees that have been supported in previous years.

Mr. ROGERS. Only two new applications?

Dr. ABEL. Yes.

Mr. ROGERS. That does not sound like we are moving very rapidly.

Of the applications you have received, how many would you estimate have been approved but could not be funded?

Dr. ABEL. As I said, Mr. Rogers, we have not received many new applications this year, and those that we received we discouraged in the informal process. That is, as you know, when people ask us about the possibilities of sea grant support, we generally encourage them to come in with an informal proposal so that we can save a considerable amount of effort on everyone's part.

In the informal process review over the past year, over the past 2 years, sir, we have discouraged further granting effort, further applications.

Mr. ROGERS. We are not encouraging the academic community or research community to do any more work?

Dr. ABEL. Not during the past 2 fiscal years, no, sir.

Mr. ROGERS. Shocking. Yet, the figures, budget figures, would indicate they are going to increase it.

I assume it is just keeping you at a level of operation.

Dr. ABEL. Yes, sir.

We are optimistic for the next fiscal year.

Mr. ROGERS. Is there any research being done for the dying coral reefs?

I know we are having some of that in Florida.

Dr. ABEL. Yes, sir.

The coral development program at Hawaii is a twin program in that it is partly intended to explore the possible utilization of coral beds and, at the same time, discover a technique for conservation of coral beds.

We do not have any work going on in coral beds off Florida.

Mr. WALLACE. May I comment on this?

There have been some other studies carried on on coral reefs. As part of our manned undersea science and technology program, we have conducted studies on specific coral reefs in the Caribbean area.

Furthermore, there have been activities relating to other coral reefs, including the Gulf of Mexico.

Mr. ROGERS. I do not believe you have any going on from West Palm Beach to Key West, do you?

Dr. ABEL. The only kind of work we have supported is \$20,000 grant to a university for a project called Scientists and the Sea, where we are collaborating with Mr. Wallace's group.

Mr. WALLACE. We did have a program in the area that you mentioned, Mr. Rogers. It was called Project Flare. In this we used a portable habitat in a number of specific areas for the very purpose that we are talking about, to study the ecology of the coral reefs and the changes that were taking place. There were several locations during the project. I cannot cite them precisely.

Mr. ROGERS. Were there any results from that?

Dr. ABEL. There is material that has been prepared and additional efforts planned.

Mr. ROGERS. Do you know about when this might be published, any idea, some timeframe?

Mr. KNECHT. I would guess within the next 3 to 4 months, there would be publications coming out of the manned undersea science and technology program of NOAA. I think the results will tend to show that some of man's activities, such as dredging, et cetera, have added sediment to the waters which in some areas are destructive to the reefs.

In that connection, we have been in discussion with the State of Florida with regard to the possibility of considering the designation of a marine sanctuary to protect certain of the reefs.

I think this offers the potential for protecting not only State-owned reefs but adjacent Federal-owned reefs as well.

Mr. ROGERS. I think it would be helpful to have a summary of these studies and what possible steps could be taken to prevent further deterioration.

[The following was submitted:]

NOAA'S RESEARCH ON CORAL REEFS

NOAA, through its Manned Undersea Science and Technology (MUS&T) Program, has been supporting scientific research on coral reefs adjacent to southeast Florida since January 1972. One of the first projects used a portable undersea habitat developed under Sea Grant to obtain basic information of coral reef, ecology. As noted in the attached summary of this program, called Project FLARE, scientists working from the habitat evaluated the present condition of various reef communities to provide a basis for noting changes as might be caused by environmental change due to natural phenomena or man's activities. The attached summary also discusses other research efforts which are related to general coral reef marine science work.

As mentioned in this summary, an ongoing NOAA research program using marine science divers has been underway since early 1972 off Grand Bahama Island. This program, which uses the Perry Foundation's Hydrolab, is providing a means by which marine scientists from academic, government, and private institutions can obtain quantitative information on the coral reef community and develop techniques that will be used for determining the health of coral reef communities.

NOAA is currently meeting with other Federal agencies including the Smithsonian Institution, EPA, and the USGS with the Harbor Branch Foundation at Ft. Pierce, Florida, the University of Florida, and the Florida state officials to develop a coordinated program for studying the Florida reefs and to determine the steps which might be taken to avoid deterioration of the reefs.

[COMMITTEE NOTE: Four reports that were printed by NOAA were received and placed in Committee hearing record file.]

Mr. ROGERS. Just a question or two more, if I may.

STORMFURY has now been halted, has it not?

Mr. EPSTEIN. Yes, sir.

Mr. ROGERS. Why?

Mr. EPSTEIN. STORMFURY has halted because there were several reasons for changing the plans of STORMFURY.

It was halted, in part, because of a response to a Department of Defense decision that they could not participate as they had been, and in part because the climatology in the area in the Atlantic in which STORMFURY was operating was working out to a point where only two storms had occurred in a number of years which could be seeded and experiments planned.

Therefore, we revised our program.

We are now in the process of building up our Research Flight Facility, and we expect that we will go in the field again in the summer of 1976 in the western Pacific, where we expect to see many storms on which we can carry out experimental seeding in order to assess the validity of STORMFURY hypotheses.

Mr. ROGERS. What planes will you use on the east coast to monitor hurricanes?

Mr. EPSTEIN. We will rely on cooperation with the Department of Defense.

Mr. ROGERS. Suppose they say they are not going to cooperate just like they did with STORMFURY?

Mr. WHITE. Mr. Rogers, the hurricane reconnaissance for hurricane storm warnings should be considered separately from the problem of Project STORMFURY, which is a research project.

The Department of Defense does perform hurricane warning reconnaissance by agreement. There is no indication at the present time that they plan in any way to reduce their hurricane-reconnaissance support.

The movement of Project STORMFURY to the Pacific is due to the fact that if we really want answers on whether man can modify hurricanes, he has got to have more hurricanes to experiment on.

We have only been able to experiment on two within 10 years in the Atlantic.

We figure we can speed up this process by a factor of four or five and get the answer in a few years if we go to the Pacific.

The point is that when we get to the Pacific, the information we obtain will be directly applicable to the hurricanes along our own Atlantic and Gulf coasts. This is the way to get the answer most quickly.

Mr. ROGERS. Was this also tied in with the seeding of clouds? Was this work carried out concomitantly?

In other words, did the staff that was involved in STORMFURY also engage in cloud seeding when a storm was not present?

Mr. WHITE. The research facility is used for a variety of weather modification activities as well as STORMFURY. It has been used for the purpose of cumulus cloud modification experiments in Florida and other weather modification experiments. The present plans are to modernize our aircraft and give us much better capability to do that.

The present DC-6 aircraft are obsolete—they are 18 years old. We really need those new facilities with new instrumentation, not only to do project STORMFURY, but to do other types of weather modification activities. And we will continue to carry those out.

Mr. ROGERS. I think it was STORMFURY in which the research group was working in seeding clouds and other related activities.

Mr. WITTE. You are absolutely right.

The aircraft were used for a wide variety of weather modification activities.

There will be no really important impact on that kind of activity. There will be some impact because the aircraft will be removed to the Pacific for the typhoon season. However they will be available for all other weather modification activities when not in the Pacific.

Mr. ROGERS. Where do your Defense Department planes come from?

Mr. WITTE. The reconnaissance aircraft that we use are supplied by the Navy and by the Air Force.

Mr. ROGERS. I know.

Where are they based now?

I understand they are no longer based nearby.

Do they not come out of Texas now?

Mr. TOWNSEND. They are now based in Texas, and they assure us that they will not in any way affect their ability to conduct reconnaissance missions.

Mr. ROGERS. I think it would, as far as refueling and capabilities of distance, would you not?

Mr. TOWNSEND. I did look into this personally, and we had assurances that we have enough time to stage—if there was a potentially dangerous storm further to the East—they made that move to effect economies in their operation and to gather the right kind of aircraft in one place.

Mr. ROGERS. I understand. Everybody welcomes economies. Economy is what brought about the halt of STORMFURY.

Mr. TOWNSEND. STORMFURY was not halted because of economy. We did, as previous witnesses have indicated, have a number of situations to contend with:

One was with lack of storms.

Two, our aircraft were getting older.

Three, we did have, this summer, the GATE experiment.

Getting back to the move, I personally looked into it because there was concern on the part of our people in Florida. My people were assured that reconnaissance efforts will be just as effective as they have ever been.

The Navy has modernized its fleet of aircraft. The Air Force has modernized its instrumentation and is converting its aircraft to C-130-H's, which is a longer-range version of the aircraft they have now.

Mr. ROGERS. I might say I also visited your people, and I get an opposite impression.

Mr. TOWNSEND. Sir, I think if you talk to the people in the Hurricane Research Laboratory, they do have a different opinion. I think your earlier question concerning the seeding was addressed to the fact that that group, in addition to seeding hurricanes, was conducting experiments on cloud lines, cloud streaks, and things of this nature, as well as research information on how these systems develop.

It is true that we have had to back down from that work during this period of modernization, and during the intensive GATE operation which is to take place this summer.

Mr. ROGERS. There were reductions in personnel?

Mr. TOWNSEND. Yes, sir.

The people associated with the Research Flight Facility suffered a reduction in force because we were not operating as many aircraft.

There were some people reduced at the National Hurricane Research Laboratory. They were people primarily working with data.

Since there was no data, we did not feel we could keep that group up to full strength.

Mr. ROGERS. That is the point I was making, lack of funding.

Mr. TOWNSEND. Yes, sir, in that case it was lack of funding, but also lack of the data that they had been traditionally working on.

Mr. ROGERS. Let me ask you quickly about satellites.

Do you have any weather satellite now?

Mr. TOWNSEND. I am sorry. I did not hear the full question.

Mr. ROGERS. You had an old satellite that was about ready to give out.

Has it given out?

Mr. TOWNSEND. No, sir.

You are referring to the synchronous satellites that are very important in hurricane forecasting.

Mr. ROGERS. In general weather forecasting.

Mr. TOWNSEND. That is correct, sir.

We have had two synchronous satellites we have been relying on for a number of years. They were the prototype synchronous meteorological satellites, and they were called ATS-1 and 3.

They had a camera on board that takes images of the full disc about once every 20 minutes. They have been remarkably long-lived. ATS-1 went almost 7 years before the camera failed, but it did fail during this past year. That was the satellite that was primarily viewing the Western part of our country and the Pacific.

The ATS-3 is younger and has shown no signs of degradation. It is the satellite that we currently make very intensive use of. It produces in general those pictures you see on TV every night.

Now, a number of years ago we undertook with NASA a development program to put together an operational synchronous meteorological satellite incorporating not only advances from the ATS program, but incorporating other very modern instrumentation. The principal differences being the new satellite, which NASA calls SMS-A, which is the prototype—well, the important difference is we get even more enhanced resolution, better detail of the earth's surface, and we get the pictures both day and night. Right now we only get them during the day.

That new satellite has suffered slips. There are developmental troubles. It is behind schedule, but as of yesterday we seem to be well on the road for a May launch.

The satellite is now in thermal vacuum testing, which is just about the last test before it is shipped. It will be launched out of Cape Canaveral, hopefully, the last week in May.

Mr. ROGERS. Does that cover completely all areas of the Earth?

Mr. TOWNSEND. No, sir. That first satellite will be moved out to the Atlantic, and it will assist us in two ways. First, it will cover the area that involves the GATE experiment, and second we will begin our hurricane watch this year with that satellite.

A second satellite will be launched sometime in the fall. It will be stationed to the Western part of our country so that we can watch severe storms in the Midwest, and get a view of the Pacific.

The United States plans two of these synchronous satellites, and we plan to keep them up there at all times in operational configuration—as opposed to research satellites.

We have promises from other nations of adding synchronous satellites to that system. Specifically, the European community through ESRO will launch one synchronous satellite; the Japanese will launch another, and the Soviet Union has promised a third synchronous satellite.

Mr. ROGERS. If you would let us have for the record the dates when these are anticipated, and also, Mr. Chairman, I think it might be well for you to explain the difference between the one going up in May and the one you will put up in the fall—

Mr. TOWNSEND. They are identical. It is a difference of where they are located.

Mr. ROGERS. Thank you.

Mr. DOWNING. Dr. White, we do have additional questions to ask of you and your associates. We were wondering whether you could come back Wednesday or Thursday of next week.

Dr. WHITE. We have a conflict with the Appropriations Subcommittee on Thursday.

Mr. DOWNING. What about Wednesday? Suppose we leave it to the staff to try to work out a reasonable date?

Mr. McCloskey has a question.

Mr. McCLOSKEY. I have several questions, but I do not think it will take over 5 minutes.

Mr. KNECHT. in your summary you state: "The increased pressures on our Nation's coastal zones, especially those associated with energy-related problems, demand the adoption of more rational coastal decisionmaking processes at both the State and Federal levels."

When you use the words "demand the adoption of more rational coastal decisionmaking processes at both the State and Federal levels," there are three areas that come to mind; oil port siting, refinery siting, and powerplant siting.

What is the administration's position on whether Federal decisionmaking should preempt State decisionmaking in those three areas?

I do not think in the time we have you can enlighten me on the details of the decisionmaking process, but I am wondering if you can enumerate for the committee the different elements, who is participating, and who is the lead agency?

Mr. KNECHT. You ask a very difficult question. I can speak to it briefly from my point of view, and then perhaps Mr. Brewer can speak to it.

From my position as director of the coastal zone management program, we have been called into discussions that have been held under the aegis of the Office of Management and Budget and other departments of the Government—

Mr. McCLOSKEY. Are they the lead agency? You say under the aegis.

Mr. KNECHT. I would like to turn it over to Mr. Brewer, and ask him to respond to that aspect of the question.

Would you be able to reply, Mr. Brewer?

Mr. McCLOSKEY. I am trying to understand the mechanism now operating to determine the administration's position, because I understand the President to say that Congress is dragging its feet on these great energy-related questions, and I would like to know where we are dragging our feet, and who is going to help guide us into the paths of righteousness in these three areas.

Mr. BREWER. I may not have the entire picture of the Government apparatus in action, but I do know that the Federal Energy Office has been active in this area, as well as the OMB, and Domestic Council.

I am not sure that an administration position has been formulated in detail.

Mr. McCLOSKEY. Why not?

Mr. BREWER. Because I think many conflicting views are being aired within the administration.

Mr. McCLOSKEY. You enumerate the individuals and the agencies that are expressing those conflicting views?

Mr. BREWER. I do not think I have full knowledge. I do not think I am able to do that.

Mr. McCLOSKEY. Who does?

Mr. BREWER. I would think one would have to go to the Domestic Council or OMB to get that information. I can, however, tell you, if you care to have me do so, the part that the Department of Commerce has been playing.

Mr. McCLOSKEY. Have you submitted any option papers to OMB and the Domestic Council on these three matters of oil port siting, refinery siting, and powerplant siting?

Mr. BREWER. We have commented on various proposals. The gist of our comments have been that the coastal program has been the way in which the Federal Government and the States coordinate their facilities toward—

Mr. McCLOSKEY. You would like to be the lead agency?

Mr. BREWER. We have not so stated.

Mr. McCLOSKEY. Is it your opinion that the Coastal Zone Office should then be the coordinating factor, that you would be the lead Federal agency in this respect?

Mr. BREWER. It would depend on what kind of program came out, as to whether there was a lead agency. There may be a separate bill entirely.

We want to make sure the coastal zone program, if possible, retains an important part in this type of siting.

Mr. McCLOSKEY. Who at Interior do you deal with?

Mr. BREWER. In this particular program I have not been dealing, or our office has not been dealing with anyone at Interior.

Mr. McCLOSKEY. What about powerplant siting, who was participating—with the conflicting views, who decides where powerplants should be sited?

Mr. ROGERS (presiding). Mr. McCloskey, I think they have an answer for you on the Interior question.

Mr. WALLACE. Mr. McCloskey, there is an intergovernmental group headed by the Atomic Energy Commission that is looking into this whole matter of powerplant siting. This group is made up of various agencies in the Federal Government, including the Department of

Commerce, Department of the Interior, and others. The focal point for this effort is in the AEC at the present time. Our agency is one of the participants.

Mr. McCLOSKEY. May I ask you if you are looking at these three areas in the same manner: powerplant siting, refinery siting, and oil port siting, they all refer to the coastal zone, and is there any inter-governmental group looking at all three with a view to coordinating this land-use decision that Mr. Knecht has pointed out so vigorously?

I just get the impression, Mr. Knecht, from your testimony that it demands the adoption of more rational coastal decisionmaking processes at the Federal level, and we better get at it.

Who is getting at it?

Mr. WALLACE. Mr. McCloskey, I think we can identify the key agency in all of these who would have the sort of overview of the thing, the CEQ, Council on Environmental Quality.

Mr. McCLOSKEY. Well, in recent days there has been some rather substantial differences between the Council on Environmental Quality and, say, the Federal Energy Office.

Let us take oil ports, for example. That legislation is in limbo right at the moment for lack of firm direction from the administration.

When we can expect direction, and from whom?

Dr. WHITE. Mr. McCloskey, we are just not in a position to comment on that. We do not have sufficient knowledge of that.

I mean, we are aware of the differences—

Mr. McCLOSKEY. What does Mr. Knecht's testimony mean then when it says it demands adoption of more rational decisionmaking processes?

I quite agree. But that testimony does not help us much if we do not know how to approach it.

Dr. WHITE. I think what we are saying is that the Coastal Zone Management Act establishes a framework in which rational decisionmaking can be made. Coastal decisionmaking applies to all the facilities that you have enumerated, and all of the other activities that take place in the coastal zone. So we do, therefore, have a mechanism in place which can make judgments as to what can be done with the coastal zone—

Mr. McCLOSKEY. Wait just a minute now. Is that testimony consistent with the President's recent statement that Congress is dragging its feet on necessary legislation?

I believe the powerplant siting, refineries, and oil ports, are all legislation which are before us to give us a more rational decisionmaking process.

Do I understand your testimony that we already have the rational decisionmaking processes?

Dr. WHITE. I am saying the Coastal Zone Management Act makes the provision for the States actually doing the planning for activities in their coastal zone, and in that sense it provides a framework.

Mr. McCLOSKEY. Do you support Federal preemption of the siting of powerplants?

Dr. WHITE. Do I? No, I do not.

Mr. McCLOSKEY. Does your agency?

Dr. WHITE. No, because we would go along with the kind of arrangements provided by the Coastal Zone Management Act, in which the States are the focal point for action.

Mr. McCLOSKEY. Do you support the preemption of the decision-making process with respect to oil ports?

Dr. WHITE. I would prefer not to comment on this, because I think I am getting into areas in which I really do not know enough details on to comment. In general what I am saying is that the philosophy that we would adopt is a philosophy that is stated in the Coastal Zone Management Act.

Mr. McCLOSKEY. You appreciate the problem, though. If the Coastal Zone Office is to then be the coordinator for these future decisions, your agency, I presume, has an opinion of whether or not the Federal Government should preempt on decisions as to oil ports, and as to refineries, if not powerplants, which you indicated you feel should be left to the States. What about oil ports and refineries?

And if you do not have an opinion because it is still under consideration by the administration, what its final opinion should be, would you so state?

Dr. WHITE. Let me just clarify it for a moment.

The Federal Government through the Coastal Zone Management Act does not make decisions for States with respect to the coastal zone. That is a task for the State under that Act. I have stated I do not know enough about the details of the executive branch opinion with regard to the preemption question, and I would prefer, because of lack of familiarity—

Mr. McCLOSKEY. I do not want to belabor the matter any further, Mr. Chairman, but I would like to pursue it with Mr. Knecht, perhaps after these hearings, as to the best means of educating Congress as to how we can move more rapidly with the resolution of these decision-making processes to which he testified.

I will leave it there.

Thank you.

Mr. ROGERS. Let me just ask one more question.

I was somewhat concerned about the administrative setup of the National Hurricane Center and their operations there with headquarters here.

It is my understanding they go through the Texas Regional Office.

Dr. WHITE. Regional Office, Fort Worth, Tex.

Mr. ROGERS. And all of their administrative housekeeping matters go through the regional office?

Dr. WHITE. That is correct.

Mr. ROGERS. Can they come directly here on any matters?

Dr. WHITE. I think that the Director of the Hurricane Center, if he is concerned, and wants to come to Washington, can certainly come to Washington, but we would expect him, however, to deal within normal channels.

As you know, we do have a new Director of the Hurricane Center, who we feel is a top-notch scientist and forecaster. He and I have had extensive discussions on this matter. It think he is fully satisfied at present that he has the necessary support to do the kind of job this Nation needs.

I do not anticipate any difficulties.

Mr. ROGERS. It just seemed, if it is a National Hurricane Center, they ought to have a direct wire here, without having to be impeded in that matter through a regional office.

Dr. WHITE. When there is a hurricane which is threatening the coast of the United States, I can assure you, communications between Washington and the National Hurricane Center take place, and take place frequently.

Mr. ROGERS. Here is what I am thinking about. Suppose they need equipment or personnel. The regional office says, oh, we do not think so, and why do you not let someone substitute or do part-time duty here. Well, he may not really be qualified to do the work the National Hurricane Center wants. Although the regional office will say we have given you your limit of personnel. You have got your ceiling.

Now, it is difficult for him to break through that. This is what I am talking about, equipment, personnel, and the problems.

I would think the National Hurricane Center, as such, would have the right to come to you directly with those problems rather than having to run through that regional office, which has more of a responsibility of a regional nature rather than a national nature.

Dr. WHITE. Of course, the National Hurricane Center in Miami has many, many important functions besides hurricane functions. We look to our regional office in Fort Worth to service all of those.

We are quite interested in seeing requests that come out of the Director of the National Hurricane Center. They should come through the regional office. We would like to see what they are so that we can be aware at least of differences of opinion between regional office and the Hurricane Center. From my conversations with the present Director of the Hurricane Center, I do not anticipate any problems of this nature. Hurricane activities, along with tornadoes, among all the weather activities we have, have the highest priority because they have a potential for destroying more life and property than any other kind of storms.

Mr. ROGERS. Suppose he requests, or has certain recommendations, will those come directly to you, or are they modified at the region?

Dr. WHITE. They would come to the Director of the Weather Service here in Washington, who I hold responsible for the entire Weather Service. I do not know whether that which comes from the regional office involves the original request from the many units under the regional office.

Mr. ROGERS. Here is what I am saying. I realize that National Hurricane Centers have other responsibilities, too, however, why shouldn't a Miami request first go through the region, if you want it to, allowing them to comment, and say whatever they want to say, but why then should that original Miami center request not come to Washington?

Dr. WHITE. I see no objection to that process at all.

Mr. ROGERS. Would it be agreeable to you? Would you issue that?

Dr. WHITE. I am prepared, Mr. Chairman, to have the requests coming out of the Hurricane Center, providing they go to the regional office for comment, on to Washington, so we can see what they are.

Mr. ROGERS. Could you make that clear to them?

Dr. WHITE. I would be glad to make it clear to my assistants.

Mr. ROGERS. I can understand your wanting to have comment on it. I think that solves the problem.

As the chairman has stated, the staff will be in touch to arrange a future date that we can pursue some other problems and questions.

As I said, I join the chairman in saying you are doing a good job with your resources, and there are difficulties in some areas because of certain restrictions in finances and personnel.

But with the resources at hand, it is impressive to hear what your reports gave to us today.

Thank you very much.

The hearing is adjourned subject to the call of the Chair.

[Whereupon at 12:30 p.m., the subcommittee was adjourned, subject to the call of the Chair.]

FEDERAL OCEAN PROGRAMS REVIEW

THURSDAY, APRIL 11, 1974

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met, pursuant to call, at 10:12 a.m., in room 1334, Longworth Office Building, Hon. Thomas N. Downing, chairman of the subcommittee, presiding.

Mr. DOWNING. The subcommittee will come to order.

This morning, the subcommittee will resume its oversight hearings on oceanic policy.

We are pleased to have with us Dr. Robert White, Administrator of the National Oceanic and Atmospheric Administration; Mr. Howard Pollock and other members of the NOAA family to resume questioning on their previous testimony.

Dr. White, will you and your colleagues please come up to the witness table.

STATEMENT OF DR. ROBERT M. WHITE, ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION; ACCOMPANIED BY HOWARD POLLOCK, DEPUTY ADMINISTRATOR; DAVID H. WALLACE, ASSOCIATE ADMINISTRATOR FOR MARINE RESOURCES; DR. ROBERT B. ABEL, DIRECTOR, NATIONAL SEA GRANT PROGRAM; DR. CLAYTON E. JENSEN, ASSOCIATE ADMINISTRATOR FOR ENVIRONMENTAL MONITORING AND PREDICTION; RICHARD GARDNER, OFFICE OF COASTAL ENVIRONMENT; JACK GEHRINGER, DEPUTY DIRECTOR, NATIONAL MARINE FISHERIES SERVICE; JOHN TOWNSEND, ASSOCIATE ADMINISTRATOR, NOAA; AND WILLIAM BREWER, GENERAL COUNSEL

Dr. WHITE. Thank you, Mr. Chairman.

I have sitting here with me Mr. William Brewer, the general counsel of NOAA. To my immediate right is Mr. Howard Pollock, the Deputy Administrator of NOAA and to his right is Dr. John Townsend, the Associate Administrator of NOAA.

We also have, Mr. Chairman, sitting in the audience and prepared to testify the group that testified the last time and gave statements. We will be here to answer questions that you may have and the pro-

gram directors are here to answer any more detailed questions with respect to the programs which you have.

I might just indicate, Mr. Chairman, that Dr. Edward Epstein, Associate Administrator for Environmental Monitoring and Prediction who delivered the testimony at the opening of these hearings is not present today. He is heading an investigatory team into the tornado disaster areas in the Midwest to examine the performance of our warning system. His place is being taken today by Dr. Clayton E. Jensen who is his deputy.

Mr. Robert W. Knecht, Director of the Office of Coastal Environment, who delivered testimony on the coastal zone management program the last time we met, is in Hawaii working with State officials relative to the coastal zone management of that State and in his stead we have Mr. Richard Gardner, who is the Deputy Director of that office. Thank you, Mr. Chairman.

Mr. DOWNING. Do you have any further opening statement, Dr. White?

Dr. WHITE. No, Mr. Chairman.

Mr. DOWNING. I have here an organizational chart of the National Oceanic and Atmospheric Administration which I will assume is the present organization.

Are you familiar with that chart?

Dr. WHITE. Yes, I am, Mr. Chairman.

Mr. DOWNING. Without objection we will insert that in the record at this point.

[Chart referred to follows:]

Mr. DOWNING. I have also the budget information for fiscal year 1975 of the National Oceanic and Atmospheric Administration and I think that that should be in the record.

Without objection that will be placed in the record at this point.
[Budget information for NOAA follows:]

STATEMENT ON FISCAL YEAR 1975 BUDGET

President Nixon's fiscal year 1975 budget request for the National Oceanic and Atmospheric Administration, Department of Commerce, is \$471.5 million—an increase of \$45.0 million, or about 11 percent more than NOAA's fiscal year 1974 funding level.

Dr. Robert M. White, NOAA Administrator said:

"The proposed budget for NOAA is directly responsive to major national needs, with strong emphasis on reducing the economic and social impact of natural disasters, promoting and protecting marine resources, and strengthening U.S. fisheries."

The fiscal year 1975 request includes major program increases to:

Improve disaster warnings, prediction, and community preparedness.

Expand environmental monitoring from earth satellites.

Strengthen U.S. marine fisheries.

Promote safe and effective use of marine resources.

Protect and conserve marine mammals.

Provide modern reference system for earth surveying.

Consolidate NOAA facilities at Fort Lincoln.

"In fiscal year 1975," Dr. White said, "we will place special emphasis on promoting the safe and effective use of our marine resources to meet national needs for:

Ocean energy supplies and marine resources,

Adequate state management of the coastal zone.

Problems arising from the disposal of waste in the marine environment,

Protecting threatened living marine resources,

Assessing the impact of deliberate environmental alteration."

An associated program proposed for fiscal year 1975 is aimed at strengthening the U.S. domestic and international economic position in marine fisheries. The U.S. fishing industry has steadily been losing its competitive position among fishing nations and has been unable to meet the increasing domestic demands for fish products. "We must vigorously undertake new and special efforts to make the U.S. fishing industry viable and competitive in both domestic and world markets," the NOAA Administrator said.

The Marine Mammals Protection Act of 1972 placed a moratorium on the taking and importing of certain marine mammals and marine mammal products. The Act imposed significant responsibilities on the Department of Commerce to conserve and protect whales and all seals and sea lions. The fiscal year 1975 budget request provides for strengthened enforcement of the Act and an expanded research program.

"A substantial share of NOAA's 1975 proposed budget," Dr. White said, "is aimed at providing a balanced program for overall improvement of the monitoring, forecasting and warning dissemination capabilities. We will expand the use of satellites, radar, and other technology for remote sensing of severe storms and begin automating our National Weather Service field operations and services. Additional efforts in community preparedness planning assistance and flash flood warnings will be directed to disaster-prone areas."

The budget request also provides for modernization and strengthening of the North American horizontal geodetic datum network that forms the basis for all public and private sector surveying.

Highlights of programs included in the proposed 1975 NOAA budget:

PROGRAM HIGHLIGHTS FISCAL YEAR 1975

MAPPING, CHARTING AND SURVEYING SERVICES

Total Program Level: \$55.0 million (including \$3.3 million in the chart sales revenues).

Program increase request (over FY 1974): \$5.2 million.

Nautical Chart Automation.—Continued program to automate all nautical chart production by 1980.

Pollution Abatement Measures.—Water pollution control systems and oily waste separator systems installed on hydrographic survey vessels.

Cook Inlet Circulatory Services.—Survey the very high velocity currents present in Cook Inlet (Alaska) to support the rapidly increased marine shipping in this hazardous region.

National Geodetic Control Network.—Modernize and strengthen the North American horizontal geodetic datum network. The network forms the basis for all public and private surveying.

Ship Basin Support.—Provide for increased ship maintenance, repair, and crew overtime to increase ship utilization.

OCEAN FISHERIES AND LIVING MARINE RESOURCES

Total Program Level: \$64.0 million (including \$1.1 million in inspection and grading revenues).

Program increase request: \$3.5 million.

Central Pacific Fisheries Development.—Develop potential skipjack tuna resource in the Pacific Island Trust Territory through a cooperative Industry-Government program.

Marine Mammal Conservation.—Protect and conserve whales and seals as authorized by the Marine Mammals Protection Act of 1972 (P.L. 92-522). Funds are requested for enforcement and administration of the Act, and for research on whale and seal populations.

Pollution Abatement Measures.—Provide oily waste separators on the fishery research vessel *David Starr Jordan*.

Enforcement and Surveillance.—Increase surveillance of foreign fishing vessels off the Alaskan and New England coasts to insure compliance with treaty regulations.

State-Federal Fisheries Management.—Provide for more effective conservation measures for California sport fish, west coast Dungeness crab, surf clams, and the American lobster off New England by implementation of plans developed with the States; development of plans for Alaska crab and salmon, and Northwest salmon.

Environmental Impact Analysis.—Review of additional impact statements required by the Ocean Dumping and Federal Water Quality Acts.

Fishermen's Guaranty Fund.—Replace Federal share in fund, depleted in FY 1974, to compensate American fishermen for vessel seizures by foreign governments.

MARINE ECOSYSTEMS ANALYSIS AND OCEAN DUMPING

Total Program Level: \$6.4 million.

Program increase request: \$1.9 million.

New York Bight Research Project.—Increase scope and level of effort in ocean dumping research in the New York Bight area.

SEA GRANT

Total Program Level: \$24.3 million.

Program increase request: \$4.4 million.

Marine Environmental Research.—Augment research on the marine ecology of the coastal zone to assist state coastal zone managers. Increased funding to provide baseline knowledge and development of environmental models of Puget Sound and other areas.

Marine Resources Development.—Provide for pilot production projects for the mariculture of lobsters, freshwater prawns, and other commercial species. Develop new products from under-utilized species and fishery wastes. Assess the economic potential and need for offshore sand and gravel resources.

BASIC ENVIRONMENTAL SERVICES

Total Program Level: \$105.3 million.

Program increase request: \$2.8 million.

Radar Observations.—Provides for the procurement and installation of a long-range basic network radar and accelerating procurement of local warning radars to replace obsolete equipment and to fill gaps in present radar coverage.

Local Ground Display of Satellite Data.—Procurement of high resolution display equipment to receive satellite pictures in local weather offices to assist in preparing warnings and forecasts.

Ground-Based Remote Sensing Research.—Expand research on remote sensing of low level temperature and wind profiles needed for local weather forecasts and warnings.

ENVIRONMENTAL SATELLITE SERVICES

Total Program Level: \$63.7 million.

Program increase request: \$6.2 million.

Geostationary Satellite Operations.—Continue the procurement, launch, and operation of the two Geostationary Environmental Satellite System (GOES). The system will provide near continuous day and night cloud imagery over contiguous U.S. and surrounding waters.

Next Generation Polar Orbiting Weather Satellite.—Provide long lead time ground equipment needed for data acquisition and command and control of the next generation of polar orbiting environmental satellites planned for FY 1977. These satellites to be operated by NOAA will succeed the polar orbiting Improved TIROS Operational Satellite (ITOS).

PUBLIC FORECAST AND WARNING SERVICES

Total Program Level: \$40.1 million.

Program increase request: \$5.7 million.

Automation of Local Weather Forecast Offices.—Implement the automated system of data collection, product distribution, and forecast and warning dissemination. FY 1975 funds will be used to begin equipping forecast offices with high speed communications, computer storage and display devices.

NOAA Weather Wire Teletypewriter Circuits.—Expand and extend the NOAA Weather Wire coverage to news media in 10 states bringing the service to 45 of the contiguous 48 states.

Community Preparedness.—Expand community preparedness efforts by providing additional personnel to assist local communities prepare plans for protecting life and property from natural hazards.

Flash Flood Warnings.—Provides for expanded surveys to determine methods for protecting communities from flash floods and preparing plans for installation of flash flood warning systems.

Water Resources Planning.—Prepare water resources studies in conjunction with the Water Resources Council and State, regional and local agencies.

WEATHER MODIFICATION

Total Program Level: \$14.0 million.

Program increase request: \$1.1 million.

Research Flight Facility.—Continue modernization of the NOAA research aircraft and facility. Funds requested in FY 1975 are for a second new 4-engine aircraft and for scientific instrumentation necessary for resumption of planned hurricane modification experiments (Project Stormfury) in the Pacific.

AIR QUALITY OBSERVATIONS AND ANALYSIS

Total Program Level: \$1.3 million.

Program increase request: \$0.5 million.

Pollution Monitoring of Atmosphere.—Provides first long-term trace pollutant monitoring in the Arctic and expands support to joint NOAA/National Science Foundation Antarctic monitoring station.

SPECIALIZED ENVIRONMENT SERVICES

Total Program Level: \$27.6 million.

Program increase request: \$0.3 million.

Solar Observatories.—Begin operating two solar observatories previously funded by NASA to provide forecasts and warnings of solar flares.

INTERNATIONAL PROJECTS

Total Program Level: \$8.7 million.

Program increase request: \$0.3 million.

Atlantic Tropical Experiment.—The Global Atmospheric Research Program (GARP) is a concerted international attempt to study the total atmosphere of the earth as a single physical system. The GARP Atlantic Tropical Experiment (GATE) is a 13-nation field experiment to study the meteorology of the tropical oceans.

The FY 1975 increase is for additional aircraft support and ship operations. *Bilateral Agreements.*—Provide for joint U.S./France undersea investigation of the Mid-Atlantic Ridge and joint U.S./U.S.S.R.¹ oceanographic studies.

EXECUTIVE DIRECTION AND ADMINISTRATION

Total Program Level: \$21.9 million.

Program increase request: \$1.0 million.

NOAA Facilities at Fort Lincoln.—Consolidate NOAA facilities in the Greater Washington area at Fort Lincoln in FY 1976. The FY 1975 funds are requested for planning and early installation of critical elements of the satellite and numerical weather processing equipment.

Note: The attached tables show "base adjustments" in FY 1975. The net increases for these adjustments are \$12.1 million and consist of \$25.9 million increases and decreases of \$13.8 million.

The major base adjustment items contained in the increases are:

Annualization of October '73 pay increase.

Payment to GSA for Standard Level User Charges.

Within-grade step increases.

Annualization of FY '74 Environmental Satellite Program Increase.

Increased costs for supplies and materials, rent, communications, utilities, and contractual services.

Cost of one extra compensable day in FY 1975.

The major base adjustment decrease items are:

Nonrecurring 1974 supplemental appropriation.

Nonrecurring capital outlay and equipment.

Transfer of Seismology and Geomagnetism programs to U.S. Geological Survey.

Discontinuance of the ocean vessel program.

NOAA PROGRAM LEVEL

(In millions of dollars)

Activity	Fiscal year--		Increases		1975 request
	Fiscal year 1973	Fiscal year 1974	Base adjustment	Program	
	program level	program level			
Mapping, charting, and surveying services ¹	48.3	44.6	+5.2	+5.2	55.0
Ocean fisheries and living marine resources ²	52.4	59.0	+1.5	+3.5	64.0
Marine ecosystems analysis and ocean dumping.....	2.6	4.4	+1.1	+1.9	6.4
Marine technology.....	4.8	3.1	+3	.....	3.4
Sea grant.....	19.5	19.8	+1	+4.4	24.3
Coastal zone management.....	.....	12.0	.....	.....	12.0
Basic environmental services.....	89.2	100.6	+1.9	+2.8	105.3
Environmental satellite services.....	37.5	62.6	-5.1	+6.2	63.7
Public forecast and warning services.....	39.1	39.5	+3.9	+5.7	49.1
Specialized environmental services.....	29.1	28.3	-1.0	+3	27.6
Environmental data and information services.....	10.1	10.9	+2.1	.....	13.0
Global monitoring of climatic change.....	.5	.8	.....	+5	1.3
Weather modification.....	4.4	12.7	+2	+1.1	14.0
International projects.....	6.3	8.4	.....	+3	8.7
Retired pay, commissioned officers.....	1.6	1.6	+2	.....	1.8
Executive direction and administration.....	17.3	18.2	+2.7	+1.0	21.9
Total, NOAA.....	362.6	426.5	+12.1	+32.9	471.5

¹ Includes trust fund receipts from chart sales.

² Includes trust fund receipts from inspection and grading fishery products and custom duty receipts in the promote and develop fishery products and research pertaining to American fisheries fund.

³ Funds for this item are contained in the Marine Ecosystems Analysis and Ocean Dumping Activity.

NOAA SUMMARY BY CATEGORY

[In millions of dollars]

Category	Fiscal year 1973 program level	Fiscal year 1974 program level	Fiscal year 1975 request
Ocean, direct appropriation.....	101.5	121.6	141.1
Promote and develop fishery products.....	7.2	7.3	7.4
Trust fund.....	4.7	4.4	4.4
Subtotal, ocean ¹	115.4	133.3	152.9
Ocean and atmosphere.....	77.2	108.1	112.4
Atmosphere.....	135.2	153.9	170.3
Earth.....	15.9	11.3	12.2
EXAD.....	19.0	19.8	23.7
Total, all funds.....	362.6	426.5	471.5
Ocean: ¹			
Operations and research and facilities.....	100.3	105.9	125.0
Coastal zone management.....		12.0	12.0
Administration of Pribilof Islands.....	3.1	3.6	3.9
Fishermen's guaranty fund.....	.1	.1	.1
Promote and develop fishery products.....	7.2	7.3	7.4
Trust fund.....	4.7	4.4	4.4
Total.....	115.4	133.3	152.9

¹ Excludes reimbursables.

Note: Amounts may not add due to rounding.

NOAA SUMMARY BY FUNDING SOURCE

[In millions of dollars]

Appropriation	Fiscal year 1973 program level	Fiscal year 1974 program level	Fiscal year 1975 request
Operations, research, and facilities.....	\$347.6	\$399.1	\$443.6
Coastal zone management.....		12.0	12.0
Pribilof Islands fund.....	3.1	3.6	3.9
Fish guaranty fund.....	.1	.1	.1
Total direct Federal.....	350.8	414.8	459.7
Promote and develop fishery products.....	7.2	7.3	7.4
Trust fund.....	4.7	4.4	4.4
Total, all funds ¹	362.6	426.5	471.5

¹ Excludes reimbursables.

Note: Amounts may not add due to rounding.

Mr. DOWNING. Dr. White, to start off with I understand that you have to go shortly, so if you will just let me know when you have to leave it will be perfectly all right.

The subcommittee has expressed some concern about the purchase of American vessels by foreign interests. In a recent edition of the Federal Register dated February 28, 1974, there was a published notice of an application for transfer of fishing vessels from American-owned interests to a British concern.

What is the feeling of NOAA on these foreign transfers?

Dr. WURRE. Mr. Chairman, it is a problem of deep concern to us also. We are, of course, conscious of the fact that as a nation across all of our economic activities we are quite in favor of the free flow of capi-

tal; ours to other countries and the capital of other countries to ourselves.

We are concerned, however, that any foreign investments in fishing activities be such that they redound to the advantage of the fishing industry of this country, the consumers of this Nation and that there should be benefits to this Nation in such foreign investments in our fishing activities.

Let me say that insofar as the entry of foreign capital into all aspects of the fishing industry aside from the vessel ownership and vessel operations, there are no restrictions on capital. It does flow freely.

Mr. Chairman, that means that we have no role with respect to the purchase of a fish processing entity by foreign capital. We become involved only pursuant to the provisions of the Merchant Marine Act of 1916 which requires that any vessel transfer to companies with foreign ownership have the approval of the Maritime Administration. Now, we became involved because the Maritime Administration seeks our advice on such transfers when it comes to fishing.

It is only through that mechanism that we do become involved and it is pursuant to that. We have published our proposed policy guidelines in the Federal Register.

We are approaching this on an essentially ad hoc basis. As you know, our proposed policy guidelines established certain constraints and conditions under which we would approve such foreign investment.

Basically, it boils down to an examination in detail of specific proposals on which our advice is sought and each proposal is examined from the point of view of impact on that particular segment of the industry and the impact on the consumer. We have the case that you are referring to, Mr. Chairman, now under close scrutiny, and we will have a decision on that very shortly.

Mr. DOWNING. And as to foreign interest purchases of U.S. fishing operations, they are subject to U.S. laws and regulations as much as the American citizen, are they not?

Dr. WIRRE. It is a U.S. corporation. It is true it may have a majority of foreign ownership but as a U.S. corporation it is subject to all laws, all rules, all regulations with respect to operation of the vessels and conservation matters.

It flies the American flag, has an American crew, and so forth, and so it is in every sense of the word an American vessel. The firm may be under the control, however, of foreign capital, but still an American firm subject to all of the laws of this country.

Mr. DOWNING. Presumably, the foreign interest could export the product back to their mother country rather than selling it in this country. Is that not so?

Dr. WIRRE. As any company, of course, it presumably would do those things which would increase its profits and how it would market its products would be up to the corporation as it is up to any U.S. corporation. I would point out, however, that today the United States imports from abroad almost 70 percent of the fisheries products that are used in this country.

Mr. DOWNING. I bring this up because there has been concern in Congress brought on particularly by the huge profits that the Arab

nations will make on the oil sales and it appears there will be a wholesale invasion of foreign money into this country buying up American concerns.

I do not know whether this is a real fear or an imagined one but it is something which we should keep in mind.

Dr. White, how do you envision the future of NOAA if it went according to your hopes, say, in the next decade?

How do you see it?

Dr. WHITE. Well, I would see NOAA evolving perhaps or I should say I would like to see NOAA evolve perhaps more rapidly than we have in the past 3 years, in spite of the fact we have had excellent programs, into an agency that can deal with the full range of ocean problems that this country faces in a comprehensive way. I think many of the major and national issues that we face today have ocean-related solutions or at least a partial solution, whether they be the problems of energy supplies or food supplies or a quality environment or recreational opportunities. There is no question in my mind that we must deal with the ocean space in a comprehensive way so that we maximize the degree to which the oceans can contribute to the solution.

Now, that would be the general context in which I would see NOAA evolving.

That would mean, for example, as we explore for oil and gas on the Continental Shelf as one energy source we would want to make sure that the oil and gas are fully developed because the Nation needs them and that the environment is adequately protected. This means a lot more knowledge of oceanic conditions that we presently have today, and although we have made a start in conducting research along these lines, I think much more remains to be done.

Mr. DOWNING. Do you see it becoming so important that it will eventually become an independent Federal agency?

Dr. WHITE. Well, Mr. Chairman, I think this is a decision that is going to be largely influenced by what the Congress feels. My personal view is that NOAA could function effectively as an independent agency.

There are many desirable features to be an independent agency but being a representative of the administration I must state that the present thinking in the administration is that NOAA can function as a major element in a department such as the Department of Commerce.

As you know, the President has proposed to establish a Department of Energy and Natural Resources in which NOAA would be combined with the Geological Survey into a new, major administration dealing not only with the oceans and the atmosphere, but also with the solid earth.

I think that if the activities of NOAA were to get sufficiently broadened and get to be sufficiently large I think the consideration for NOAA as an independent agency would have to receive a lot more attention than it has at the present.

Mr. DOWNING. I am going to ask Dr. Jensen a question on these tornadoes.

Is he present?

Dr. WHITE. Dr. Jensen is here. By all means. Perhaps Dr. Townsend or I could answer them.

Mr. DOWNING. As to these recent tornadoes that took so many lives in Ohio and surrounding States, did the people have any warning of the path of these tornadoes?

Dr. WHITE. Mr. Chairman, Dr. Townsend and I specifically visited the tornado disaster areas just last Friday. The purpose was to examine exactly this question. We visited Louisville, Indianapolis, and Cleveland in three of the States where we had some of the severest weather. I am pleased to be able to report to you that on the basis of the evidence which I saw and this involved questioning residents in the area, questioning the people who issued the warnings, asking the press what their reaction was to these various questions, that is, did the warning system work well.

This was one of those situations in which the developing tornado condition was recognized early in the morning and the system was alerted to be on guard for tornadoes very early, many hours in advance of the tornado outbreaks.

Actual warnings of the tornadoes were available for most of the areas. I say "most" because I do not have a full, detailed report yet from all of the areas for a time period ranging anywhere from 5 minutes up to 40 minutes.

Now, with regard to the issuance of an actual warning and a warning means to take cover, to take cover now, as being adequate time for people to protect themselves by going to a shelter or removing themselves from a place of danger and so we are satisfied at least at the present time on the basis of the information I now have with the operation of that warning system.

Now, I have appointed a high level investigatory team which is now out in the field in all of the communities struck by tornadoes to examine whether there were any deficiencies in the warning system.

I am sure that we will find, as we have in almost all disaster instances, where our warnings could have been improved or where something could have been improved in the system. I do not have the information yet so I can give only my preliminary assessment that the warning system worked well.

Mr. DOWNING. When a tornado activity develops, it is the responsibility of your office to notify the area involved, is that not correct?

Dr. WHITE. That is correct.

Mr. DOWNING. Then do you have enough knowledge to predict the path of a tornado?

Dr. WHITE. The prediction of paths of tornadoes is a very difficult thing.

Where a tornado has a long path, for example, where the path extends over 50 to 100 miles and the tornado has been identified it becomes possible to track it and give people downstream on that track quite a bit of advanced warning.

Now, that actually did happen in many of the tornadoes in this last outbreak because some of the tornadoes, for example, in Indiana and Ohio, had very long paths.

It is almost impossible, however, to predict where the funnel of the tornado will first descend from a cloud and it tends to be in those conditions where the warning is very, very short because the funnel may descend from any one of a number of convective cells, that is, thunder storm type circulations.

It is very difficult to predict which one will actually spawn the tornado funnel and where it will actually strike the ground, so the answer has to be a combination. If there is a long path we can predict the path and give adequate warning. The actual initial touchdown is very difficult to predict.

Mr. DOWNING. In the recent NASA authorization bill, I believe, an amendment was adopted by the committee to authorize funding for research into tornadoes by the NASA agency.

Do you have any liaison with NASA in this regard?

Dr. WHITE. We have the closest kind of liaison with NASA on this.

One of the key elements in the observing system which enables us to detect tornado situations, of course, is the geosynchronous satellite. In this outbreak we used the advanced technological satellite 3 which is over the Atlantic Ocean which gave us information about the whole tornado situation.

We worked with NASA on the development of the new operational prototype of the geosynchronous satellite system which will be launched next month. We also worked with NASA on the development of sensors that would go on the satellites that might be of use, for example, in tornado detection, so we have very close working relationships with NASA.

Mr. DOWNING. Back to another question. If your warning system was effective in this recent tornado disaster, how was it so many people were killed?

Dr. WHITE. That is the \$64 question and I hope my investigatory team will come back and answer that in detail, but let me give you some possible answers.

First, if you go through some of the devastated areas as we did or fly over them, the first reaction you come away with is, my God, how come the loss of life was so small, because the devastation is almost total and the fact that almost anybody could survive under that situation seems almost a miracle. I think as a general statement the advanced warnings were very effective in holding down the loss of life significantly. Nevertheless, one has to ask the question, why was so many lost as you are asking?

First of all, in order to take action they have to get the warning. How do we issue our warnings? We issue them by radio, television, and newspapers, and our own broadcast systems.

Now, if you are not listening to a radio or do not have your television set on, it is not always easy to understand that there is actually a warning in being, so that you can take cover. Many people do not hear the warnings. People do not hear the warnings because they do not have access to some medium that would give them the warnings. That is one possible reason why people would not hear the warnings even though they were issued in time.

The second thing would be that all protective locations are not available. Some of the areas that were struck by tornadoes do not have basements.

Now, if you get a tornado warning in your house the thing you want to do is go to your basement. You want to get away from any possibility of flying debris. That means if you do not have a basement in your house, or if there is not a shelter around, it is very difficult for you to take shelter even though you have the warning.

Another possible reason why lives would be lost is that there is not adequate shelter to which people can repair when a warning occurs.

There are reasons why one might expect lives to be lost even if there were good warnings but for reasons that are extraneous to the warning system itself. This gets to the question of devising techniques that do not depend on, for example, the person having turned his radio on, a technique that, for example, might automatically turn your radio on even if you do not turn it on yourself.

There are such techniques and we are now beginning to deploy them in many parts of the country, particularly along the coast. These are, what we call our VHF-FM NOAA weather broadcasts which operate 24 hours a day that have a tone alert system on them.

That means we can trigger from the weather station the operation of a radio set when an alarm or a warning is put out.

Now, we are trying to get those placed into hospitals and other places of mass assemblies, so that even if they do not have their radio on it will be automatically turned on for them.

Mr. DOWNING. Automatically turned the individual's radio on for him and broadcast?

Dr. WHITE. Yes, sir, or some other warning device.

The other thing that I think needs to be done is for a wider use of the siren systems of the Civil Defense activities.

Now, this varies from one part of the country to the other. Wherever we have had direct access to siren systems we have found them enormously useful.

Some years ago, for example, in Minneapolis, we had a very devastating tornado but there we had access to the siren system and we were able to press the siren button and many lives were saved. The sirens vary from community to community and the control varies.

We are working with the Civil Defense Preparedness Agency to try to get greater access to the siren system so you do not have to be dependent on a radio or TV set. You will actually have warning no matter what kind of communications media you are listening to.

Mr. DOWNING. We still have the nuclear alert system in this country, do we not?

Mr. WHITE. Yes.

Mr. TOWNSEND. Let me comment. The sirens that Dr. White was referring to are part of the Civil Defense Alert System. Under the law as I understand it, those systems are run by the local communities. They are not run by the Federal Government, per se.

The Federal Government is responsible for the total system, the architecture and the interstate communications, but the local communities are the ones that determine how these sirens are used, and the details of what shelters are provided. One of the problems has been that not all of the communities have been convinced of the need for the sirens in a tornado or severe thunderstorm situation.

Dr. WHITE. The last item I would just mention here on this topic, Mr. Chairman, we also find that when a community has an adequate community preparedness plan it is able to respond much better to a disaster such as this. We have a program where we work with the communities to set up such preparedness plans. We find that in community preparedness plans are very much up to date.

In areas where these disasters are infrequent the community preparedness plans generally tend to be less adequate, and this is something that one must do more on, and that is on community preparedness planning. It is very useful.

Mr. DOWNING. I think the committee would like to see a copy of that investigative report when it is ready.

Dr. WHITE. Be glad to supply it to you, Mr. Chairman.
[The report follows:]

PRELIMINARY REPORT—THE WIDESPREAD TORNADO OUTBREAK OF APRIL, 3-4, 1974

INTRODUCTION

Because of the magnitude, both in terms of geography and the number and intensity of the tornado occurrences, this report, of necessity, will be very preliminary and tentative in nature. As of April 23, 1974, definitive data on storm tracks and times along with supporting input from the NWS regions, are still incomplete. Follow-up field visits are still being pursued. Our goal is to have most of the necessary information by May 1 with a draft report ready for internal review in about six weeks. This is later than the reporting date requested when the Survey Team was established, but it is believed that the great extent of the outbreak makes this additional time necessary.

The basis for this report has been derived mainly from the results of the NOAA Natural Disaster Survey Team's visit to the five states hardest hit by the tornadoes. The team consisted of the following members: Dr. Edward S. Epstein, Associate Administrator for Environmental Monitoring and Prediction; Gerald A. Petersen, Director of Meteorological and Hydrological Services; Herbert Lieb, Public Affairs; Vince Oliver and James Purdom, NESS; Phil Dales, NWS.

Most of the team arrived at Birmingham on April 5 and by April 12 had covered the most severely damaged areas in Alabama, Tennessee, Kentucky, Indiana, and Ohio. In addition, the NWS regional headquarters teams who had arrived on the scene within six to twelve hours after the tornadoes, provided briefings on the results of their survey within Georgia, Alabama, Tennessee, Kentucky, Indiana, and Ohio. Personnel from offices in Missouri, Illinois, Michigan, West Virginia, Virginia, and North Carolina also will be contributing material on the tornadoes affecting their respective states. On the basis of the initial survey and reports, segments of the survey team are now visiting additional sites in Tennessee and Illinois.

GENERAL DESCRIPTION

In the view of Fujita of the University of Chicago and Pearson of the National Severe Storm Forecast Center, this outbreak was a once in a century event that far exceeded the 1965 Palm Sunday tornadoes in terms of numbers, length of tracks, total area affected, deaths, and damage. Although we cannot be absolutely certain at this time, somewhere between 75 and 85 tornadoes occurred within the area generally encompassed by a line from Chicago southward almost to the Gulf of Mexico and eastward to the Appalachians. There is little question that several of these tornadoes were among the most severe ever observed.

Initial Red Cross Information indicates the following overall statistical data:

Deaths	328
Injuries (1,183 hospitalized)	6, 142
Dwellings destroyed or with major damage	13, 458
Dwellings with minor damage	8, 390
Mobile homes destroyed or with major damage	3, 000
Farm buildings destroyed or with major damage	6, 867
Small businesses destroyed or with major damage	1, 427
Total families suffering loss	27, 590

Newspaper accounts place the value of property lost at 540 million dollars. The most concentrated physical damage was sustained in the city of Xenia, Ohio. However, several rural communities (e.g., Guin, Alabama, Brandenburg, Ken-

tucky, Monticello, Indiana) suffered comparable losses on a lesser scale because of their smaller size. Deaths were reported in the following eleven states:

Alabama -----	86
Kentucky -----	77
Tennessee -----	50
Indiana -----	49
Ohio -----	35
Georgia -----	17
North Carolina -----	7
Michigan -----	3
Virginia -----	2
Illinois -----	1
West Virginia -----	1

Loss of life could have been much greater especially in the case of Xenia where several schools were severely damaged. If the storms had come through during school hours, as many as 1,000 of the 5,000 students who attend the schools damaged or destroyed by the tornado in Xenia might have lost their lives. At Monticello, Indiana, a tornado passed directly through the business district in the late afternoon killing two people. However, many of the stores are closed on Wednesday afternoons. Thus, the downtown area was not nearly as busy as it normally is and, once again, loss of life was limited through good fortune. In many other cases, it was also evident that the late afternoon and early evening timing of the tornadoes permitted exposure to the dissemination of warnings through radio and television as well as direct observation by the people.

THE WARNING SYSTEM

The NOAA team plans on evaluating the total warning system extending from the National Weather Service production stage to the public response stage at the community level in its full report. In this discussion, a brief overview that touches on production, dissemination, and public response will be given.

Production.—For the most part, the NWS portion of the warning system performed remarkably well under the most trying of conditions. In a condensed chronological order, the sequence of events began on Tuesday, April 2, when the Director of the National Severe Storms Forecast Center alerted all Central Region offices with radars to the likelihood of a serious outbreak the following day. This word was also passed to the Regional Warning Coordination Center at Ft. Worth where the same message was moved out to Southern Region field offices. The early morning severe weather outlook of April 3 outlined the area where practically all tornadoes eventually occurred along with the statement that "scattered", as opposed to the more normal "few", tornadoes were expected. The SELS unit issued a total of 30 tornado watches between 3:50 a.m. CDT on April 3, and 6:15 p.m. CDT on April 4, although most of the killer storms occurred on Wednesday, the third. Countless severe thunderstorm and tornado warnings were issued by the Weather Service Forecast and Weather Service Offices over almost the same period of time. As far as can be determined, practically all of the tornadoes occurred in valid watch areas but not all occurrences were covered by actual warnings.

A substantial problem seemed to be the difficulty experienced in trying to keep up with the numbers of watches and warnings, some of which overlapped one another at times. This was compounded by the fact that the tornadoes moved at speeds of as much as 50 to 60 knots. The value of our network and local warning radars in handling the forecast problem cannot possibly be emphasized enough. A large fraction of the warnings issued were based on the form of the radar echo, rather than visual sightings. Thus, the radars were absolutely essential to issuing timely, early warnings, as well as in tracking visually recognized destructive cells. As a corollary, emergency power is a must item, especially at all radar sites. The Covington WSR-57 was out of action for three hours. Fortunately, most of the worst of the tornadoes had already occurred by this time, and some backup was available from Wright-Patterson AFB. The Huntsville local warning radar was able to operate continuously only because emergency power was available and power surges due to the storms were damped out. At Louisville, although power was not lost, the many surges did make the radar inoperative from time to time; only exceptional performance by the electronic

technician, changing parts and recalibrating at frequent intervals, kept the radar performance at a reasonable level. In addition, the Lexington WSO was without power from 7:38 p.m. CDT, April 3, to 2:44 a.m. CDT, April 4. This included the period when storms were active in the Lexington area. A mobile city police unit manned by the police relayed reports from the WSO beginning at 8:30 p.m. CDT but the Office had to rely mainly on FTS and intermittent use of NAWAS while WSFO Louisville prepared and issued the formal warnings.

Satellite information available at the Kansas City and Suitland SFSS was used to good advantage in identifying areas of potentially severe and ongoing severe weather. The Kansas City SFSS staff closely coordinated its efforts with those of the NSSFC and the RWCC, while both SFSSs communicated directly with field offices. An analysis is being performed to relate the ATS images, the radar data, and the severe weather occurrences to illustrate the extent to which these complement one another. The satellite information did contribute to the warning system in the present situation. In the future, with operational GOES systems, there is great promise of very substantial benefits to warning capabilities with the anticipated higher quality satellite imagery.

Special mention of the outstanding performance on the part of the WSFO and WSO staffs involved should be made. They did a wonderful job with many of the personnel staying on the job throughout the whole period of occurrences.

Dissemination.—The most important element in the dissemination process was the active participation on the part of television and radio. As far as could be determined, most stations did not hesitate to interrupt normal programming with warnings as they were received. There were several examples of TV stations who did extremely well. Although not without exception, those TV and radio stations with NOAA Weather Wire Service did the best job of all. Those visited praised the value of having this service. Even in the case of the stations relying on the wire services, we noted that they transmitted the warnings as received. It was not possible to determine how timely the wire services were but, in at least one case, the delay was eight minutes.

Clearly the relation of time of day to the listening habits of the public has a strong influence on the rate at which warning information diffuses. Longer warning times are particularly important during times when fewer people can be reached directly by radio or TV, to permit the message to spread by word-of-mouth, as it indeed does.

The most outstanding example of performance by a radio station took place at Brandenburg, Kentucky, where the station was located two or three miles upstream in the path of the tornado. The announcer of this small FM station observed the tornado coming and continued to broadcast a warning until the station was literally destroyed. The only thing left standing was the woman's bathroom which does say something about a possible place to look for shelter.

As another part of the dissemination problem, those stations with hours of operation limited to a schedule (e.g., sunrise to sunset) should be made aware of the fact that in emergencies they are permitted by FCC rules to continue on the air. In addition, the Emergency Broadcast System needs attention to take advantage of its potential role.

In our press briefings, the question of VHF/FM came up again and again. It is the NOAA team's view that this capability, along with tone alert receivers in all schools, hospitals, and in local government facilities, would be an important asset to our ability to provide rapid and effective dissemination. Again, emergency power in all offices with this means of transmission would be a necessity in the event of power failure. This also applies to the provision of "all clear" messages when all other means of communication might be out.

The question of watches and warnings was repeatedly raised in the states not usually exposed to frequent tornadoes. In the small rural community of Guin, Alabama, however, not one person was interviewed who was unable to distinguish between the two. This suggests that frequency of occurrence along with continual education does overcome the difficulty of distinguishing between a watch and a warning. We simply must do more in educating the public and must provide the media with an appropriate explanation as the events occur. In our final report we will deal directly with this question of how warning messages should be phrased. At this time, we recommend no change.

Public Response.—This is the biggest variable in the complex chain reaching from production to action. Larger cities with active Civil Defense efforts seem to do very well although the question of more sirens was raised many times.

The NOAA team emphasized the importance of preparedness at all our press briefings. As was the case in Alabama, people took decisive action by getting into basements, storm cellars, or inner parts of houses. They opened windows and doors and called neighbors. At other locations, in less tornado-prone areas, some people knew what actions to take while many did not. Although the school system in Xenia had a disaster plan, they had never conducted a tornado drill. It is our view that all officials with public responsibilities should be aware of the proper actions to be taken. Tornadoes are perhaps as likely as fires in public buildings. Education and movement of preparedness planning down to the smaller communities within the Nation presents a larger problem. The challenge is there for NOAA as well as for other agencies such as the DCPA. In our report, we will be addressing this aspect and the total system in detail.

We know from specific incidents that have been related to us, that the NOAA warning system helped in saving hundreds of lives. Were it not for the timely warnings by the Weather Service, the total loss of lives on April 3-4, might have been several thousand.

TENTATIVE FINDINGS AND RECOMMENDATIONS

Our tentative findings and recommendations are summarized in this section. In general, we do not foresee any major changes in them, although they will be expanded in the report as added supportive material becomes available.

Findings.—In general, the team has determined that :

(1) NMC products gave accurate and timely forecasts of a major large scale storm development 36 hours in advance.

(2) NSSFCC gave widespread notice a day in advance to get ready for a major storm day. Radar and radio preparedness was emphasized.

(3) SFSS gave 24-hour notice to NNESS Operations to go to storm day routine. Pictures from ATS-3 were available at 30-minute intervals from 5:59 a.m. CDT until 1:49 p.m. CDT at which time pictures at about 13-minute intervals until 6:24 CDT were obtained. There was insufficient illumination to continue operations over the outbreak area after this time.

(4) The early morning NSSFCC "AC" outlook very accurately outlined the area in which storms occurred.

(5) Tornado watch "boxes" were prepared and disseminated prior to nearly all the days' tornadoes. Some confusion resulted, both in our field offices and with the media, due to the large number of boxes, some of which overlapped in time and space. Radar plots of existing storms appear to be the presently most used tool in preparing tornado watch boxes.

(6) Network and local warning radars were absolutely essential to the success of our tornado warning program. In the press briefings, there were many questions about improvements in existing, as well as concerns about expansions in local warning radar coverage. Offices without radars or radar remotes were at a terrible disadvantage in trying to track and forecast the storms.

(7) The lack of direct broadcast capability via VHF-FM in most of the area affected limited the effectiveness of the warning dissemination. This also received frequent attention from the media and the NWS offices visited.

(8) The lack of emergency power was very evident in the case of the Covington radar and in keeping local warning radars operating under the stress of power surges.

(9) Although NWWS (and RAWARC) stood up very well under the strain, there are far too many radio and TV stations without this service. We did note routine data being hauled on NWWS in a few cases when it may have been better to place total priority upon warnings and statements. Also, there were some problems in relaying information from one state to another via NWWS. In addition, there is no question that our torn paper tape manual operation should be replaced by AFOS which will enhance our capability to respond as quickly as technology allows to severe weather situations as well as to streamline our whole communications system.

(10) The preparedness activities on the part of state and local officials in Alabama and Tennessee were very effective, whereas, in the more northern states with less frequent tornado occurrences, there were many locations without any effective disaster plans at all.

(11) The overall performance of the plans and equipment and the people of the Weather Service was superb. In a number of cases particular commendations should be issued.

Recommendations.—As a result of the findings, the following items deserve the utmost attention and support.

(1) Expand VHF as quickly as possible. Its usefulness in rapid and efficient transmission of warning messages especially to local officials, schools, hospitals, etc., within thickly populated areas would significantly enhance our ability to disseminate information.

(2) Acceleration of the radar program is a must item. In our view, local warning radars provide the most effective tool available for detecting and forecasting the movement of storms at the office level. At a minimum, every WSO with county warning responsibility should have a radar remoteing device. Visual imagery is an essential factor in being able to handle severe weather situations.

(3) Emergency power at all offices with county warning responsibility is an important item. This is particularly so for those offices with radar capability.

(4) AFOS must be implemented as quickly as possible if we are to obtain improvements in our ability to be as responsive to disasters as technology permits.

(5) Community preparedness activities in cooperation with other Federal, State, and local government agencies should be expanded right now. An additional specialist at all WSFOs will go a long way toward helping in preparedness planning and education, as well as in other areas such as the development of improved spotter networks.

(6) The newly developed tornado detectors also should receive attention. In our view, these devices could provide another source of valuable information upon which to base severe thunderstorm and tornado warnings.

(7) A techniques development staff located at NSSFC, as we have at NIC, will aid greatly in determining new ways and new applications of the data to be derived from radars, satellites, and other conventional sources.

(8) With the planned May launch of GOES, twice-per-hour high resolution imagery will become available. All WSFOs, especially in severe weather areas, should have the capability to receive this data. The ATS-3 data contributed to the handling of this outbreak and we fully expect GOES data to be even more valuable in detecting and tracking severe weather events.

Mr. DOWNING. I see that Dr. Abel is in the audience. I have a question for him.

Dr. ABEL, how many colleges do we have now under the sea grant program?

Mr. ABEL. There are 119 universities being directly funded. The total number is in excess of 150.

Some grants will range over as many as, in one case, 17 different universities and colleges, sir.

Mr. DOWNING. Do you have a goal? How many do you hope to get?

Mr. ABEL. Yes, sir; we believe that at a point of leveling off which would take place perhaps at the end of the decade or so there ought to be between 18 and 23 sea grant colleges in the country.

Some of these, such as the University of Rhode Island would be a single university. Others, as in the case of the University of California, our latest sea grant college, would encompass 10 universities.

Mr. DOWNING. Well, that is an important program, and I am glad to see it proceeding.

Mr. ABEL. Thank you, Mr. Chairman.

Mr. DOWNING. Mr. Pritchard?

Mr. PRITCHARD. I would like to ask Dr. Abel: Is there not danger here of spreading this so broadly that we are unable to get the quality and the impact that we want?

Mr. ABEL. Yes, sir; there could be. It is simply a matter of judgment.

We have a system of proposal, filtration which we believe to be about as tight as is possible within the Federal system.

For instance, the sea grant director is a type of person unique to this

program. He is, in effect, our man on campus, and their man in Washington. He acts as the local filter for all grant applications.

For instance, this particular year the University of California system received something in excess of almost \$6 million in original applications.

The sea grant director, assisted by his colleagues, has filtered this down to perhaps one quarter of that amount.

Now, when the proposal comes to us, we will send its components out for review.

These component projects may be as few as 9 in the case of the Virginia Institute of Marine Sciences, which operates in particular specialty, to as many as 80 in the case in the University of Wisconsin.

After we receive our mail review, we conduct further examination in our own office, and finally conduct an on-site examination consisting largely of members of our sea grant advisory panel.

Ultimately, the grant will be distilled to perhaps 5 to 10 percent of what its original concept would have been at the local level.

Mr. PRITCHARD. Well, I think you in NOAA are concerned too if in all these programs we continue to broaden base. At a time when the wrestling for money gets more intense, and I do not see it getting easier, I am concerned about spreading it out so far. We have governmental programs down the road that have an intense need for money.

Mr. ANEL. We have found that using a sea grant director and a single, shall I say master college system in the case of a sea grant college resolves a lot of problems right at the base.

The University of Washington is a sea grant college. That university handles subgrants to Highline Community College, Shoreline Community College, Seattle Central Community College and Clover Park Community College.

Each of these prosecutes a program or a project. They are going to be prevented from growing outward by the influence of the central university system. Our sea grant director, Dr. Murphy, has a local control of the system. Before any other college in the State of Washington is likely to propose for sea grant support, the strong probability is that it will pass through that university first, and thus be blended in with the rest of the projects in that university.

There are 39 in all this current year, designed around three or four central themes. This way we will almost automatically prevent a useless proliferation.

Mr. PRITCHARD. Well, I have great faith in what you are doing, but I see this continual spreading of the base. I am very concerned that we are just not going to have the finances to adequately back up the effort.

As I say, I have a lot of faith, and appreciate what you have been doing.

Mr. ANEL. There are two points I would like to add, Mr. Pritchard: As the Congress originally spelled out the Sea Grant Act, the enabling paragraph is the instruction to establish a network of sea grant colleges.

This we believe to be fairly binding on our charter.

Second, as Congress designed the act, every cent the Federal Government spends is to be matched by one-half as much from the local sources.

Now, while this minimum of one-third of the total is observed very carefully in theory in actual fact it has grown close to 50-50.

Eleven States now have direct appropriations specifically allotted to the sea grant program.

At this point in time, for every cent that is appropriated by the Congress for sea grant, almost an equal amount of money is furnished by local industries, State governments, and private foundations.

Mr. MOSIER. Will the gentleman yield?

Mr. PRITCHARD. Yes.

Mr. MOSIER. As I remember it, last year at your suggestion we gave a very small amount, or we released a very small amount to you folks to be used on a discretionary basis, which did not have to be matching; the idea being that there were certain uses that you would have that would be in the national interest that would not require any matching.

Did we do that, and have you made good use of that? Has it been helpful?

Mr. ABEL. Yes, sir; it has been extremely helpful. The maximum allowed to us was 1 percent of our total budget.

We have used approximately one-half of 1 percent of the budget for this in three grants so far, one to continue the sea grant seventies, which is in essence our national organ, that is our catalogue of reports, and issued documents; second, a special grant to MIT to explore and identify those technologies which might over the next 10 years most likely enhance the U.S. position in its balance of trade; and third, a grant to review the sea grant program in terms of its practical payoffs, and in terms of what sectors of economics seem to be most useful across the country.

Mr. MOSIER. That MIT study sounds interesting. Do you have any report from them yet?

Mr. ABEL. No, sir; this was recommended by our advisory panel a year ago, and it actually took me about 10 months to find an organization that had the experience in this area, that had the competence to do the work, and was willing to take on a study of this kind.

We finally ended up with Dr. Herbert Holloman at MIT 2 months ago, and he is just getting into the study now.

Mr. MOSIER. What is the probable date of that report?

Mr. ABEL. We hope he can have something useful to us in 18 months.

Mr. MOSIER. Thank you.

Mr. PRITCHARD. I was not here when Dr. White was talking.

I am heading back to my district, and I am sure the natives who are fishermen in my area are very restless.

On page 8 you say some small progress has been made in the Pacific.

Just so I will be a little better armed, you might tell me some of the progress we have made in the Pacific.

Dr. WHITE. It is putting an optimistic light on a situation, Mr. Pritchard. There have been some agreements with the Japanese, particularly in the Pacific. Let me ask Dave Wallace to speak to that.

Mr. WALLACE. I think the major problem that exists in the Pacific Northwest at the moment is the situation regarding the intensive fishing carried on by the Japanese for the salmon on the high seas. This has become a matter of major concern, particularly as a result

of the failure of the Bristol Bay run in Alaska last year which was almost catastrophic, not only for the fishermen, but the processors as well, many of whom were in the State of Washington.

Director Robert Schoning is now a member of the International Commission for the North Pacific Fisheries, INFC. We have taken a very hard line that there must be some accommodation on the part of the Japanese to the U.S. needs to preserve and conserve this resource. Our position has been developed on the basis that the United States has many regulations controlling our fishing.

We have improved the habitat for spawning and survival in the streams, themselves. We are therefore saying that since we nurture the resource we must have a major share of the salmon reserved for the United States.

The Japanese position has been that those salmon that are beyond a certain line in the Pacific ought to be available to their fishermen.

We have taken the position that particularly now, in view of the crisis situation that we have in terms of salmon, we must move further than we have in the past to meet the situation.

I must say that the Japanese have not been too anxious to make major concessions. Right at this moment, we are in almost continuous negotiation with the Japanese, hoping to get some major concessions that will help to protect the salmon on the high seas. I think we will.

Mr. Pritchard. Well, I certainly agree with your analysis.

The thing I was searching for was that certain little scintilla of progress that was mentioned here.

Mr. Wallace. I think we have to talk about that in a slightly different context. Maybe we should discuss the State-Federal relationships in terms of fisheries which we have been developing with the States of Washington, Oregon, California and Alaska.

At the moment there is an intensive program going on to develop a comprehensive plan for the development of the dungeness crab resource. I think it has moved very well. The States are working very closely with the National Marine Fishery Service and the Gulf States Fisheries Commission so that we now have a sort of master plan for the development of this resource; and it is being supported by all segments of the Government and the industry, also.

This is a new kind of approach to fisheries conservation, and I think it is working.

We are also attempting to develop more capabilities to harvest some species in the Pacific that have been under-utilized by the United States, but which have been heavily exploited by the Japanese and the U.S.S.R. This is moving, too, so that our fishermen are going to be able to do better in this area.

The price structure has helped to some extent because the demand for fisheries products is improving. This gives more incentive from an economic standpoint to the fishermen.

These are some of the highlights, but I cannot say that we have solved the problem.

Mr. Pritchard. The other thing is have you noticed any change at all by the Japanese in their negotiating position because of their development of a coastal salmon industry? I have had reported to me that they had 7 million chum salmon come back last year by a gentleman who was there, Dr. Donaldson, whom I think you know.

Mr. WALLACE. Yes, I do.

Mr. PRITCHARD. He talked about the possibility that since the Japanese are now developing a coastal salmon industry, they are getting very, very worried about the North Koreans and the South Koreans, and everybody else coming along and fishing and fishing now for their coastal salmon. Maybe there will be some change.

Mr. WALLACE. This might probably be a most helpful development.

I think the problem with the Japanese in the past is that they have been faced with the U.S. concern about salmon on the one side, and with the Soviet concern for the Eastern Pacific on the other side. The runs of salmon into the U.S.S.R. have been a tremendous bone of contention between the Japanese and the Soviets. The Japanese have, in a sense, had their backs up, because of these pressures from both the United States and the U.S.S.R.

This has meant that they have almost developed an inflexible position. That they have to have these fish because their people need them for food.

If they could develop a resource of their own, which they then had to nurture, it could very well ease some of the pressures and make them more flexible in their negotiations with the United States.

Mr. PRITCHARD. I would hope that your people would look at the techniques they are using.

Our information is that their runs out of hatcheries have greater returns than we are getting off of ours. Dr. Donaldson, who went up there and lived with them, said the Japanese Government is not reporting all the facts, but they are getting at least a 10 times greater return off their hatcheries than we are getting—at least out of the State of Washington.

The Japanese have not only copied us; they have far surpassed us.

Mr. WALLACE. I think they have been successful in this effort. There is no question about it.

There has been some success in the United States also. In some of our Columbia River hatcheries, for example, we are getting three or four times as many fish returning from the hatchery stocks as we were 15 or 20 years ago. So there is the upgrading of the stock, genetic selective breeding, all the things you have to do to domesticate a species. This is almost the fundamental of aquaculture. This is where the future lies.

Mr. PRITCHARD. I know you gentlemen know that time is running out in this whole area, and the 200-mile limit is not something that is just being talked about. It is a reality, and if real progress is not made, and apparent progress is not there in Caracas, Venezuela, why you are going to have a 200-mile limit pass this Congress, if I am any judge. As one who represents a salmon area, this is a very ticklish prospect, because the salmon will not be saved by the 200-mile limit.

We will have to have some kind of bar on netting procedures on the high seas, or there will not be any North Pacific salmon for any country.

Mr. WALLACE. Let me make this comment.

As you know, our Deputy Administrator, Howard Pollock, is part of the U.S. Delegation to the Law of the Sea Conference in Caracas. He has been deeply involved in this from its very conception, and we are very sensitive to it.

A 200-mile limit, alone, will not take care of the specific needs of the salmon.

Mr. PRITCHARD. I am very aware of that. As one who sits here, I want you to know that the feeling of Congress is that they are going to push the 200-mile limit through. You talk about it so much that I am just fearful that to the people in the Department here this is just another cry of wolf.

Mr. POLLOCK. We have no illusions about that.

Mr. PRITCHARD. You are painfully aware of it, are you?

Mr. POLLOCK. Yes.

Mr. WALLACE. We certainly are.

I would like to point out the problem we are having with the Japanese right now is the salmon migrates 1,000 or 1,200 miles from our coast. If we had the 200 miles alone, and then unlimited fishing on the high seas, this would not take care of the salmon problem.

Mr. PRITCHARD. I realize that, and I was making that statement.

Mr. WALLACE. I think we have to look at the salmon problem in the Law of the Sea Conference context as an anadromous species problem.

Mr. PRITCHARD. Mr. Pollock has that responsibility, and since he comes from Alaska, I am sure he understands our problem.

That is all I have, Mr. Chairman.

Mr. DOWNING. Mr. Mosher?

Mr. MOSHER. Dr. White, in your review of NOAA here, and I am sorry to say I have not been here some of the time, has there been any reference to your proposals for a Great Lakes Center, and the progress there?

Dr. WIRRE. This has not come up in these hearings, but I can give you an account of where we stand on that, Mr. Mosher.

We have, as you know, been planning the establishment of a Great Lakes Center which would consist of bringing together all of the elements of NOAA that are in the Great Lakes region so we can provide better services in the Great Lakes.

We have decided to locate that in the vicinity of Ann Arbor, Mich. We will be moving the first of the laboratories there, the Great Lakes Research Laboratory this July.

We are not going to formally establish the Great Lakes Center until such time as we can get adequate resources to do the kind of job that we think needs doing up there.

Many of the elements of the Center will be up there, and some of the groups from Washington will move out there starting this summer.

Mr. MOSHER. Now, you say you will not actually establish a center until you can get adequate funding. Is that what you are saying?

Dr. WIRRE. Well, what we visualize doing in this Center is being able to provide a comprehensive set of services. These would involve hydrologic services, lake level provisions, the mapping activities that already exist there, and a research program which looks at the whole range of lake-related problems in the sense of relation between the physical, chemical, and biological characteristics of the lakes, the coastal zone management problems.

We will establish a laboratory that will do this research, and as I indicated, this summer.

We are planning to strengthen our fishery liaison in the Great Lakes, the commercial fisheries liaison activities.

Now, many of these things at the present time are adequately funded. We have funds and people in there, and the programs are going, and those are being moved up there.

There are some aspects of it that still require additional support, and we will be discussing this, of course, within the administration in connection with the fiscal year 1976 budget.

Mr. Mosher. You are pulling together there then, you are not only putting together the existing functions, but you are expecting to expand on those functions?

Dr. Wirre. Yes; we are, Mr. Mosher.

Mr. Mosher. And establish a new emphasis and a new coordination. That is the whole idea.

Dr. Wirre. That is correct.

Mr. Mosher. And you will need additional funding, but you are not really requesting that until fiscal year 1976, is that what you are saying?

Dr. Wirre. Our plan is to request it in the fiscal year 1976.

Mr. Mosher. Well, if you need help I am sure some of us would like to be helpful.

You are pleased with the way things are going?

Dr. Wirre. Generally; yes.

Mr. Mosher. What about the commercial fishing in the lakes?

Are there any trends there that are opening?

Dr. Wirre. Let me perhaps turn to somebody more knowledgeable about the commercial fishing activities up there in the lakes, but my general impression is that they are tending to come back, and there is growing interest in commercial fisheries in the lakes.

Perhaps Dave Wallace will want to comment.

Mr. WALLACE. I think that there is some indication that the species that are of commercial interest are beginning to come back into the lakes. Stocks of lake trout, salmon, and whitefish have been re-introduced, and there seems to be a shifting in the balance that we had a few years ago. We were faced with the decimation by the lamprey eel of the key fish that were present there. Nevertheless, there still are areas of the lakes where the incidence of wounds on larger trout is very high, consequently, there has been no significant increase in young native trout. The control of lamprey spawning in deep water estuarine regions has not been effective which accounts for the continued predation.

Dr. Wirre. I was going to comment that it is not my rôle to ask a question, but David, it is my understanding that there has also been some effect from the combination of the control on pollution in the lakes, that is as we begin to clean up the lakes, the outlook for the future would be for an increased restoration of stocks there as a result of better pollution control.

Mr. Mosher. Well, these hopeful trends, although minor trends as yet, these hopeful trends to better the pollution situation and some return of useful species of fish, is it merely coincidence that they are at a time of record high water levels in the lake?

Can those high water levels have something to do with this?

Is the mere fact that more water, and more flow, and so forth, is that a factor?

Mr. WALLACE. I must say that I cannot answer this question. I really do not know whether it is a factor or not.

Mr. MOSIER. Of course, the high water levels are a disaster to some people, the property owners along the lakes. The eroding and the flooding is tragic, but I wonder if at the same time those high level waters meant cleaner lakes, and perhaps an advantageous environment for the fish.

Mr. WALLACE. My inclination, Mr. Mosher, would be that this has not had a major impact on the fishery stocks.

Mr. MOSIER. Just a coincidence?

Mr. WALLACE. Yes, sir, there has been another development, and this ties in with the recreational fisheries there.

As those of you who are familiar with the Great Lakes know, for a number of years when the lamprey was destroying the fish that were very desirable, there was a burst of growth of alewife which, in some ways, almost dominating the populations in the Lakes. Surprisingly enough, the introduction of the coho salmon has had a tendency to somewhat control the alewives, and convert them into a much more desirable product, at least from the standpoint of recreational fishermen. This has been another parallel development that has been taking place.

Mr. MOSIER. Thank you, Mr. Chairman.

Mr. DOWNING. Dr. White, I understand you have another meeting, so you feel free to leave at any time.

Dr. WHITE. Thank you.

Mr. DOWNING. A question for Mr. Pollock.

What can we do, either Congress or NOAA, to improve the status of our fishing industry?

I am more familiar with the east coast than I am with the west or gulf coasts, but I know our vessels average 40 or 50 years in age, and insurance premiums on them are so high that three yearly premiums could purchase a vessel.

The industry so far as its facilities are concerned is in a deplorable state.

Does NOAA have any responsibility in this regard?

Mr. Wallace. Mr. Chairman, there are several laws passed by Congress which have to do with assistance to the fishing industry to maintain its ability to fish successfully. I must say in all candor that these efforts have not had any dramatic, favorable impact on the fishing industry. There are many, many reasons why this is so.

It seems to me that we have two basic problems to deal with in our commercial fisheries.

First, we have to make certain that we have the capability and the situation wherein we can maintain these stocks at high levels so that fishing becomes a viable enterprise for a fisherman. This means that we must be sure that we do not deplete the stocks of fish.

Second, when our fishermen do have these stocks available they must have the capability to fish them.

Now, one of the available means at the moment is a loan guarantee in which the Federal Government actually guarantees the loan, through commercial channels, to fishermen to improve their vessels, to get better equipment, better nets, and this kind of thing.

Mr. DOWNING. A guarantee of 75 percent, as I recall it.

Mr. WALLACE. Yes; I am told that is correct.

This, in itself, is a substantial help, it seems to us, and offers an opportunity for a fisherman in a local area to deal with his local bank which is protected from the major part of the risk that might be involved. Obviously, for a fisherman, if there is some question about the stock, there is a substantial risk involved. We hope that in areas where the stocks are depleted, we will not have an influx of modern fishing equipment because the stocks themselves are not sufficient.

On the other hand, there are many underutilized or underdeveloped species. We are pushing very hard in the New England area, for example, to work with the industry to develop markets for these products. One species, the Jonah Crab, has come along very well. Another species is the squid, for which we are working with the industry to develop the fishing know-how, and also to assist and advise them in the methods of distribution and marketing. I believe there are these aspects which are favorable as far as the fishing industry is concerned.

Mr. DOWNING. I have a fisherman whose boat sank in the bay last week, and he wanted a new boat. I called Maritime, and they said they had two programs.

They said one was the 75 percent loan guarantee for a new vessel. The other program for the purchase of a used vessel was in a state of flux caused by GAO, so we really only have one program in existence now, and it does not appear to me to be very effective.

I do not know what further legislation is necessary. That would be up to the Congress, of course. But also it is your responsibility, too, if the resource is there, and we do not have the vessels, to go out and get them. We are in bad shape.

Mr. WALLACE. Mr. Chairman, this is an area of considerable concern to us.

We have not really been able to determine how best to assist our fishermen. We are looking at all of these various procedures at this present time. We have a vessel subsidy program. But even this has not given us the substantial results we had hoped for.

Mr. Chairman, I would like to suggest that we be given an opportunity to submit to you a resumé of these various programs with a concise analysis of them for the record, and where we stand in each one.

Mr. DOWNING. The committee would appreciate that very much, because this is of serious concern to the entire community.

[The material follows:]

FEDERAL FINANCIAL ASSISTANCE PROGRAMS AVAILABLE FOR COMMERCIAL FISHERMEN

(1) FISHING VESSEL OBLIGATION GUARANTEE

The fishing Vessel Obligation Guarantee Program, administered by NMFS and authorized by Title XI of the Merchant Marine Act, 1936, as amended, facilitates the private capital market's responsiveness to the investment capital needs of domestic commercial fishermen by guaranteeing financial obligations given to aid in financing or refinancing up to 75 percent of the cost of constructing, reconstructing, or reconditioning commercial fishing vessels of 5-net tons or over.

Briefly, the Fishing Vessel Obligation Guarantee program works this way. A borrower finds a lender either directly or by requesting NMFS assistance in finding a lender who is willing to finance or refinance up to 75 percent of the

cost of (1) constructing a new fishing vessel or (2) reconstructing or reconditioning a used fishing vessel. They (the borrower may make initial application without the lender) then apply for a Title XI guarantee of the obligation (note, bond, debenture, etc.) which the borrower proposes to give the lender. If approved, the Secretary of Commerce pledges the full faith and credit of the United States to payment of the obligation. The Secretary's guarantee serves as the lender's sole security. All mortgage or other collateral arrangements are confined to the Secretary and the borrower. The borrower must provide the remaining 25 percent as well as meet minimum net-work and net-working capital requirements suitable to his situation. The program requires a demonstration of economic soundness. The maturity of guaranteed obligations given to aid in financing the construction of new vessels may not ordinarily exceed 15 years. The maturity of those financing reconstruction or reconditioning may not ordinarily exceed 7 years.

A guarantee fee is charged annually as a cost of the guarantee. All fees collected are deposited into a Federal Ship Financing Fund for use in redeeming guarantees exercised by lenders.

(2) CAPITAL CONSTRUCTION FUND

Section 21 (46 USC 1177) of the Merchant Marine Act of 1970 amended section 607 of the Merchant Marine Act, 1936, as amended, to provide for a Capital Construction Fund. The purpose of the Fund is to provide a Federal Income Tax deferral mechanism to stimulate capital accumulation for replacement vessels, additional vessels, and reconstructed vessels for, among others, the U.S. commercial fishing fleet. With specific regard to fisheries, the objective is to allow the U.S. commercial fishermen to remain on a competitive basis with foreign fleets, particularly those which have experienced technological advances made possible by subsidies from their Governments.

From a practical standpoint, the Capital Construction Fund permits fishermen to deposit their earnings into an account in a private depository (their individual Fund), and to withdraw them later for use in conjunction with improvement of existing vessels or acquisition of new vessels. This system becomes significant when the provisions of section 607 of the Merchant Marine Act are applied. Section 607 provides for a deferral of Federal income taxes on deposits into the Fund and earnings from investment or reinvestment of amounts held in the Fund. The Fund can be deposited into an approved bank account or invested in interest-bearing securities (including stock) as may be approved by the Secretary of Commerce. Tax deferral operates through the mechanism of having qualified withdrawals work to reduce the tax basis of the vessel for which the withdrawal is made. The result is that the depreciation deduction is reduced and taxable income is greater in later years thereby eliminating tax avoidance. This provision has the effect of deferring tax on ordinary income or capital gains on these deposits so long as they remain in the Fund or are used for the purposes for which the Fund is being maintained. Use of deposits into the Fund without prior approval can subject the Fund owner to termination of Fund privileges and the reimposition of the previously deferred tax liability.

Those who wish to avail themselves of the benefits of the Fund must first be U.S. citizens who are owners or leasees of "eligible vessels". Thereafter, they must enter into an agreement with the Secretary of Commerce in order to establish a Capital Construction Fund with respect to their eligible vessel or vessels. The agreement, which is subject to terms and conditions specified by the Secretary, may require them to deposit a certain percentage (not to exceed 50 percent) of their annual taxable income attributable to the agreement vessel into their Fund (in a private depository). In addition, deposits can be made which are equal to the depreciation taken during the year on the vessel, net proceeds from the sale of an agreement vessel, and insurance and indemnity proceeds attributable to the vessel.

Subsequently, participants in the program may make withdrawals from the Fund, with the consent of the Secretary, for the purpose of (1) acquisition, construction, or reconstruction of a "qualified vessel", or (2) payment of the principal on indebtedness incurred in connection with the acquisition, construction, or reconstruction of a "qualified vessel".

For purposes of the Act, an "eligible vessel" (one which may be made subject to an agreement for purposes of deposits in the Fund) is any vessel constructed

or reconstructed in the U.S., documented in the U.S., and operated in the fisheries of the U.S.

A "qualified vessel" (one of which withdrawals can be made) is a replacement vessel, additional vessel, or reconstructed vessel constructed or reconstructed in the U.S., documented in the U.S., and which will be operated in the fisheries of the U.S.

(3) FISHERIES LOAN FUND

NMFS also has authority for the administration of a direct loan program (Fisheries Loan Fund) under Section 4 of the Fish and Wildlife Act of 1956, as amended, (16 USC 742c), and the authority vested in the Department of Commerce by Reorganization Plan No. 4 of 1970. The Act authorizes a revolving fund from which loans are available to finance or refinance the cost of purchasing, constructing, equipping, maintaining, repairing, or operating new or used commercial fishing vessels or gear.

A February 22, 1973, General Accounting Office Report to the Congress entitled *Need to Establish Priorities and Criteria for Managing Assistance Programs for U.S. Fishing-Vessel Operators* concluded, among other things, that the Fund had experienced only limited success in attaining "the national objectives of making the U.S. fishing fleet more efficient and more competitive". The report, although recognizing that the Fund had been administered in accordance with its authorizing legislation, recommended that the Fund be redirected in order to improve its effectiveness. The Fund was placed under an application moratorium effective March 1, 1973, in order that we might study and evaluate the various alternatives for improving the Fund's effectiveness. The moratorium was additionally justified by the fact that the Fund balance was depleted and did not offer a potential for significant impact (loans before the moratorium had been limited to an administrative moratorium of \$40,000 each due to a ready lack of lendable capital). We have in the interim established, conceptually, how we believe the Fund should be redirected in order to make it more effective. We are now in the process of (1) developing the specific mechanisms we believe necessary to successfully effect that redirection, and (2) evaluating whether or not the requisite authority and capital are available.

(4) FISHERMEN'S PROTECTIVE ACT

The Fishermen's Protective Act (22 USC 1971-1979) helps fishermen absorb the cost of being seized on the high seas by foreign governments claiming territorial jurisdictions not recognized by the United States (anything over 12 miles is not presently recognized by the United States).

The Act of August 27, 1954, provided that in a case where a vessel of the United States is seized by a foreign country on the basis of rights or claims not recognized by the United States and there is no dispute of material facts concerning the location or activity of the vessel, the Secretary of State is to take such action as he deems appropriate to protect the vessel and crew and secure their release. In addition, the vessel owner is to be reimbursed by the Secretary of the Treasury in an amount certified by the Secretary of State for any fines paid to secure such release.

The Act of August 12, 1968, amends the earlier Act by authorizing similar reimbursement for sums paid for license fees, registration fees, or any other direct charge. In addition, the 1968 Act provides that the Secretary of Commerce, upon application, shall enter into contracts with fishing vessel owners providing that in the case of seizures under the conditions stated above, the Secretary of Commerce shall guaranty the owner or charterer of such vessel for all actual costs except the fines, license fees, etc., taken care of by the Secretary of the Treasury. The actual costs to be guaranteed by the Secretary of Commerce are those resulting from damage to or destruction of the vessel, its gear and equipment; loss or confiscation of the vessel, gear and equipment; and dockage fees or utilities. In order to finance this, a Fishermen's Guaranty Fund was established into which annual fees from fishermen and appropriations from the Government are deposited. The relative share being specified as having net fees contribute not less than one-third nor more than two-thirds of the appropriated revenue. In addition, all administrative costs are deducted from fees before they are made available for payment of claims.

The guaranty extends also to the owner (or charterer) and the crew for the market value of fish caught before the seizure but lost by confiscation or spoilage

during the period of detention; and for an amount not to exceed 50 percent of the gross income lost as direct result of the seizure and detention according to a formula provided in the Act.

Where the guaranty runs to the owner and crew, the distribution by the Secretary will be made in accordance with the usual practices in that particular segment of the commercial fishing industry.

(5) FARMERS HOME ADMINISTRATION (FHA) LOANS

By virtue of the Rural Development Act of 1972 (Public Law 92-419) the Farmers Home Administration may make or insure loans to fish producers and processors, fishery cooperatives, and individual fishermen for purposes of improving the general economic and environmental climate in rural areas. This includes financing and developing business, industry, and employment. The FHA may also undertake joint loans to these parties (in conjunction with the Economic Development Administration, the Small Business Administration, and other public and private entities) for the same purposes.

However, if the Secretary of Labor certifies to the Secretary of Agriculture within 60 days of the application that the proposed financial assistance—

(1) is likely to result in a transfer of the applicant's business activity to another area (unless part of an expansion, provided the expansion does not adversely affect certain economic conditions); or

(2) would result in the increased production of goods and services for which there is insufficient demand to promote economic efficiency (unless there would be no adverse effect on area competitive enterprises), then no assistance will be granted.

For purposes of the Act, "rural areas" may include all the territory of any State not within a city of 50,000 persons and not within the urbanizing area of such a city. "Urbanizing area" means an area with a density of more than 100 persons per square mile. However, special consideration for loans must be given to areas other than cities of more than 25,000 persons. Interest rates are set by the FHA according to a formula which takes into account prevailing rates and FHA operating costs.

(6) SMALL BUSINESS ADMINISTRATION (SBA) LOANS

The Small Business Act (15 USC 631 et seq.) makes provision for several loan programs.

Under Section 636(a), the SBA is authorized to make loans to small businesses to finance plant construction, conversion, or expansion, including the acquisition of land. Loans may also be issued to finance the acquisition of equipment, facilities, machinery, supplies, or materials, or to supply such businesses with working capital. Loans may be made either directly or in cooperation with lending institutions. Loans will not be made if reasonable credit is obtainable elsewhere or if there is a specific government legislative body designed to assist a particular sector.

At present, insofar as the fishing industry is concerned, SBA limits the availability of loans under Section 636(a) to shore operations (fish processors).

Under Section 636(b)(2), SBA is empowered to make loans to a small business if it has suffered economic injury as a result of a natural disaster as determined by the Secretary of Agriculture. With respect to the fishing industry, these loans are available only to oyster growers.

Under Section 636(b)(4), SBA may make loans to businesses which have suffered economic injury due to their inability to market an inventory because of disease or an occurrence of toxic algae (red tides) rendering the product unfit for human consumption. Note that the product must actually be affected by disease or toxicity. For example, a mere public scare resulting in decreased shellfish sales would not be covered.

(7) FARM CREDIT SYSTEM LOANS

The programs discussed above are all administered by the Federal Government. The following program is a new source of funds in the private sector brought into being by the Farm Credit Act of 1971 (Public Law 92-181)

The Farm Credit System is a Federally chartered cooperative banking system owned and controlled by its borrowers. It has as its overseer the Farm Credit Administration, an independent Federal Agency. Farmers and cooperatives who

borrow are required to purchase stock in the System to assist in capitalization. In order to obtain money for loans, the System sells notes, bonds, and debentures on money markets, and lends money from its own stock. Institutions of the Farm Credit System available to fishermen are:

a. Production Credit Associations

Individual fish producers and harvesters may borrow through over 400 local production Credit Associations.

In addition, a group of ten or more harvesters or producers may organize a Production Credit Association, provided conditions are met and approval is granted by the Governor of the Farm Credit Administration.

Any Production Credit Association may make loans and give technical and financial related assistance to, among others: (1) producers and harvesters of aquatic products for general business operations, including equipment and family living requirements; and (2) persons furnishing to producers and harvesters services directly related to operating needs.

Production Credit Association loans are for up to seven years maturity.

b. Banks for Cooperatives

Eligible fishery cooperatives may borrow directly through 13 Banks for Cooperatives. Individual fishermen, although they may borrow directly from Production Credit Associations, may not do so directly with respect to Banks for Cooperatives. In addition to loans, these Banks may provide other technical and financial assistance. There is no statutory limit on the maturity of loans from Banks for Cooperatives.

c. Federal Land Banks

Finally, all rural residents (including Fishermen) may obtain housing loans from either the Production Credit Associations for up to seven years maturity, or from a Federal Land Bank (another part of the Farm Credit System) for up to forty years maturity.

All Farm Credit System loan applicants must submit complete financial information and a statement as to the purpose of the loan. They are entitled to prompt notice of action on their application, and supporting reasons if there is a denial. A provision for reconsideration is also included. Interest rates for borrowers depend on the cost of borrowing money from money markets and on operating costs and are adjusted periodically over the term of the loan to reflect changes in such costs. Loan amounts are based upon individual need.

Mr. Heyward?

Mr. HEYWARD. Thank you, Mr. Chairman.

I would like to ask a few general questions of Dr. Townsend, Mr. Pollock, or whoever wants to answer them.

First of all, in connection with the President's budget, it has a list of the various activities of NOAA at certain levels.

In February you furnished a summary of your 1975 budget. The figures do not come out the same.

I wonder when the President's budget was put in concrete, and how did these figures get in that you have submitted as your program requests for 1975?

Mr. POLLOCK. I think it would be appropriate to have Dr. Townsend, with the help of some of our other people, to answer that question.

Mr. TOWNSEND. Mr. Chairman, the only change I am aware of since the President's budget was forwarded to Congress in January is a recent request for a supplemental that we have appeared before the Congress on—before the Appropriations Committee.

That request covered the necessary funds to annualize and pay for the pay increases that have come each year.

A second part of that supplemental dealt with our Pribiloff Islands

program, where we have been badly hit by inflation, particularly on the cost of oil up there.

A third part of that supplemental concerned the implementation of the recent agreement with Brazil concerning the offshore shrimp fisheries.

I believe that those are the only changes that have occurred. The status there is that we are expecting a report from the House Appropriations Committee at any minute now.

I do not believe that it is out formally yet.

Mr. HEYWARD. Well, perhaps it is simply the way the figures are assembled, but the last time you were here, for instance, Mr. Mosher asked a question about sea grant.

The President's budget shows \$23.2 million. The February issue that you have shows sea grant at \$24.3 million.

Now, this is not a major change, but it represents a difference of \$1 million.

I just wonder what the correct figures are. Your totals, including some trust fund receipts are something like \$471.5 million. The President's budget shows \$426.4 million. That is a difference of \$50 million.

I just wonder what the correct figures are. I grant you the President's budget is in terms of estimates, but it is an indication of what is going to be requested.

I just wonder when the changes took place, since last October, September, or just when?

Mr. TOWNSEND. We will have to put together and compare figures. There should not be any confusion here. The budget was submitted. There are substantial adjustments to base in it, and there are carryover funds involved from a previous year. These could possibly be part of this difficulty.

Mr. HEYWARD. Well, the 1975 request for coastal zone management is listed on yours as \$12 million. That is what you actually requested. That is not including any carryover funds, as far as I know. You asked for \$12 million, and you got some carryover also, have you not?

Mr. TOWNSEND. We have asked for a \$12 million level in fiscal year 1975.

Mr. HEYWARD. I would appreciate it if you could compare the figures so that there would be some explanation as to the apparent differences between what we looked at in the President's budget as expecting NOAA to request.

We are interested in knowing how the programs are being either added to or subtracted from.

Mr. TOWNSEND. There have been no changes, with respect to that 1975 budget since it was sent forward by the President to Congress in January, save only the supplemental request, so the rest of it must be in how the figures are being handled, sir.

Mr. HEYWARD. I am sure you are right. We will see.

Why does the President's budget describe NOAA under the title of "Science and Technology?" Are you limited to science and technology?

Mr. TOWNSEND. No, sir, we are not limited to science and technology, but the Department of Commerce, when it submits its budget, in brief, to the Congress, has usually included us in that category.

When we were the Environmental Science Services Administration,

or rather when some of us were, that activity was underneath the Assistant Secretary for Science and Technology, in Commerce.

That is no longer true though at the present time. I think it is just a convenience categorization.

We are more scientific and technical than we are anything else.

Mr. HERWARD. I do not doubt that, but I think that maybe a change of image would be helpful to indicate that you are not restricted to science and technology. You have many, many programs, and in fact, Dr. White's statement was that NOAA was set up to be a central focus for previously conducted ocean activities. The image might be better if the budget title did not give the impression that you are predominantly a science and technology agency.

I think that is one of the problems that the committee has had in the past on whether or not the present arrangements for NOAA really solves the purpose of what the Congress intended.

In connection with your interagency relationships with other agencies, we were furnished a week or so ago a memorandum from the Coast Guard in connection with activities on the surveillance of the fishery laws.

Do you have similar types of operational agreements, or perhaps you have not found them necessary, with the Navy, for instance, on mapping and charting, with FDA on wholesomeness of products, with other agencies along those lines, where you do have a dual responsibility?

Mr. TOWNSEND. Yes, sir; we have a number of such agreements, and we also have a number of bilateral, coordinating activities with agencies where we have a mutual problem of concern.

In some cases we coordinate through various interdepartmental committees, such as the Interdepartmental Committee for Marine Science and Engineering.

The mode varies depending upon the need. Generally, when another agency is putting its resources directly in with ours, in a joint program, we do execute an interagency agreement.

In other cases where our money goes only for our activities, and the same is true on the other side, we will have sometimes less formal mechanisms.

We can furnish you for the record, if you like, a list of the principal agreements here.

[The list follows:]

SIGNIFICANT MEMORANDUMS OF AGREEMENT BETWEEN COMMERCE (NOAA)
AND OTHER FEDERAL AGENCIES

Department of Commerce and the Department of Defense. 1968.

Regarding utilization of the facilities of the Coast and Geodetic Survey in the event of national emergency.

Regulations Governing Cooperation of The Coast and Geodetic Survey With the Armed Forces. 1954.

Department of Defense and the Department of Commerce. 1954.

Regarding utilization of the facilities of the Coast and Geodetic Survey in the event of national emergency.

Geological Survey (Dept. Interior) and Coast and Geodetic Survey (Dept. Commerce). 1947.

To assist in planning cooperative programs of mapping and surveying in the United States.

Geological Survey (Dept. Interior) and Coast and Geodetic Survey (Dept. Commerce). 1947.

To assure cooperative planning of advance programs.

National Bureau of Standards and Coast and Geodetic Survey. 1963.

For the operation of a cooperative magnetic observatory at Boulder, Colorado.

Department of Defense and Department of Commerce (Coast and Geodetic Survey). 1966.

Geometric satellite management concept—primary and secondary nets.

U.S. Navy and Coast and Geodetic Survey. 1962.

To support United States contribution to the bathymetric program of the International Hydrographic Bureau.

Federal Aviation Agency and ESSA. 1966.

To establish working arrangements for providing aeronautical charts.

Federal Aviation Agency and ESSA. 1967.

Regarding planning, programming and budgeting for aeronautical charts.

DOC, FAA & Commerce. 1965.

Establishing Inter-Agency Air Cartographic Committee.

Memorandum of Understanding Concerning Operational Coordination Between U.S. Army Engineer District, Detroit, and Lake Survey Center, National Ocean Survey, NOAA. 1973.

Bonneville Power Administration (Dept. Interior) and Weather Bureau, ESSA (Dept. Commerce)

To establish an automatic hydrometeorological data collection network. May 16, 1966.

Soil and Water Conservation Research Division (U.S. Dept. of Agriculture) and Weather Bureau

For cooperation research on the physical processes involved in snow metamorphosis and snowmelt. July 1966.

Forest Service (Dept. of Agriculture) and Weather Bureau, ESSA.

To establish and operate a MESO-Scale Network for studying evaporation in mountain regions. Original dated August 15, 1961—Supplement No. 1 dated May 21, 1965, Amendment No. 1 to Supplement No. 1, March 1966.

Forest Service and Weather Bureau.

To provide fire-weather service and conduct fire-weather research. 1961.

Air Defense Command and Weather Bureau (Joint use of ADC Radar).

To develop procedures for joint use of ADC Radar facilities. 1959.

Air Weather Service and Weather Bureau (Flight Operations at Civil Airports).

For weather support to U.S. Army flight operations at civil airports. 1965.

Department of Agriculture (Soil Conservation Service) and Weather Bureau.

For work in flood prevention and watershed protection activities. 1955.

Department of Interior (Bonneville Power Administration) and Weather Bureau.

To operate and maintain meteorological networks and river forecasting service. 1957.

Forest Service (Fire-Weather) and Weather Bureau.

For improved fire-weather forecasting and related forecast improvement studies. 1961.

Forest Service and Weather Bureau (Sacramento Range District).

Federal Aviation Agency and Weather Bureau (Salt Lake City Air Route Traffic Control Center).

Participate in a cooperative program to provide radar weather surveillance. 1966.

U.S. Forest Service and Weather Bureau (Fire-Weather Washington).

To operate a portable fire-weather forecasting unit of fires. 1963.

Tennessee Valley Authority and Weather Bureau (Meteorological Forecast Services).

For providing a wide range of qualitative and quantitative weather forecast information. 1966.

Headquarters Air Defense (Dept. Air Force) and Weather Bureau.

For weather observations from ADC radar sites.

Federal Aviation Agency and Department of Commerce (ESSA).

For establishment of working arrangements for providing aviation weather services and meteorological communication. 1965.

National Aeronautics and Space Administration and Department of Commerce (NESG). 1973.

To define relative roles of NASA and DOC with regard to establishing and operating the operational environmental satellite system.

Department of Commerce and Department of Interior.

Transfer of global, National and regional earthquake monitoring and related services to the U.S. Geological Survey. 1973.

Department of Commerce and Department of Interior.

To clarify the roles and missions of the U.S. Geological Survey and NOAA in meeting National needs for seismological and geomagnetic data. 1973.

Department of Commerce and Department of Interior.

To outline various points of data exchange and service that NOAA and the U.S. Geological Survey will provide each other to insure the uninterrupted continuation of the Tsunami Warning Service, also seismological and geomagnetic program. 1973.

U.S.A.F. Air Weather Service and NOAA.

To provide for joint manning of Space Environmental Services Center at Boulder, Colorado, with communications link from Boulder, Colorado to Offut Air Force Base on joint support of High Latitude Monitoring System at Anchorage, Alaska. 1972.

Department of Commerce and the Department of Transportation.

U.S. Coast Guard to provide logistic support and personnel to the NOAA Data Buoy Office.

Department of Commerce on the National Aeronautics and Space Administration.

To establish basic operational support to be forwarded by NASA to NOAA facilities located at Mississippi Test Facility. 1971.

Letter of Agreement between NMFS and the Smithsonian Institution.

Concerning collection and utilization of certain dead marine mammals for scientific research. 1973.

Memorandum of Understanding between the Department of Interior and the Department of Commerce.

Concerning the Joint Enforcement of the Endangered Species Act of 1973.

Interagency Agreement between NOAA/NMFS and the U.S. Coast Guard.

Concerning joint enforcement of Federal statutes and international agreements related to living marine resources. 1973.

Declaration of Policy between the Bureau of Sport Fisheries and Wildlife and NMFS.

Concerning protection, conservation, development, and management of certain fish and wildlife resources. 1973.

Memorandum of Understanding between the Bureau of Sport Fisheries and Wildlife and NMFS.

Concerning joint administration of the anadromous fish conservation Act of 1965, as amended. 1973.

Memorandum of Understanding, Department of Interior, Fish and Wildlife Service, and FTC. 1959.

Describes respective roles in the investigation of fishery cooperatives guilty of price enhancement.

Memorandum of Understanding, Department of Interior Fish and Wildlife Service and Department of State. 1959.

With respect to the minerals and fisheries officer program, provides for the assignment of fishery attaches to foreign service posts.

Memorandum of Understanding, National Marine Fisheries Service and Bureau of Sport Fisheries and Wildlife. 1972.

Specifically describes activities of NMFS and BSF&W as they relate to farm reared catfish.

Memorandum of Understanding, National Marine Fisheries Service and Forest Service. 1973.

Describes NMFS advisory responsibilities to FS. Also provides for cooperative research.

Mr. TOWNSEND. For example, we have been working with the Department of the Interior for a number of years in trying to improve the coordination. We have several mechanisms there.

I chair, along with the Deputy Director of the U.S. Geological Survey, a committee that coordinates and does more than coordinate, in some cases we actually direct work, all activities in the mapping, charting and some of the other areas where we have a good deal of mutual interest with the Geological Survey.

That bilateral arrangement has just been expanded to include the Bureau of Land Management because of the problems of the potential lease of large amounts of acreage in the Outer Continental Shelf for the production of gas and oil.

Mr. HEYWARD. I think a list of those would be helpful, because I think the record should show where these interagency interplays come in, and how they are coordinated, to at least lend some reassurance that it is not duplication, where two agencies have overlapping responsibilities. That is the primary problem I was getting to.

Also, I wonder if you could furnish the committee with a list of the advisory committees, both statutory and agency advisory committees, their duration, and the approximate cost thereof.

Mr. TOWNSEND. We will be glad to do that. We have a committee management system within the Department of Commerce, and that is done in quite a formal fashion.

[The information referred to follows:]

ADVISORY COMMITTEES

SPONSORED BY NOAA

New York Bight MESA Advisory Committee

- Panels (a) Information User Advisory Panel
- (b) Scientific and Technical Advisory Panel
- (c) Citizen and Industrial Advisory Panel

Termination date: November 18, 1975

Total cost to NOAA: \$27,500—1.25 man-years of staff support

Coastal Zone Management Advisory Committee

Termination date: August 29, 1975

Total cost to NOAA: \$12,000—1.0 man-years of staff support

Marine Fisheries Advisory Committee

Termination date: January 5, 1973

Total cost to NOAA: \$15,700—0.8 man-years of staff support

Marine Petroleum and Minerals Advisory Committee

Termination date: March 20, 1976

Total cost to NOAA: \$50,000—1.0 man-years of staff support

Sea Grant Advisory Panel

Termination date: January 5, 1975

Total cost to NOAA: \$31,000—0.5 man-years of staff support

OTHER ADVISORY COMMITTEES

National Advisory Committee on the Oceans and Atmosphere

(P.L. 92-125)

Advisory Committee on Aircraft Noise Abatement Program

(Department of Transportation)

Flight Information Advisory Committee

(Department of Transportation)

Mr. HEYWARD. One further question, following on the chairman's question in connection with the sale of vessels. I realize that the decisions are made under the marine laws, as far as these sales are concerned.

When Dr. White put out his first interim proposal, a proposal for an interim policy, back last October, what was the legal basis for that? Did that result from some contact from MARAD asking NOAA to establish some sort of a policy in this regard?

Mr. TOWNSEND. Yes, sir, I remember the incident, it involved a sale on the west coast. We immediately got together with the Maritime Administration on this matter.

Mr. HEYWARD. And the actual decisionmaking is done by MARAD?

Is there any assurance that NOAA's objection would be honored by MARAD, or is that understood, rather than agreed upon?

Mr. TOWNSEND. No, sir, there has been an exchange of correspondence with MARAD in this matter. We make a recommendation to them. They are the ones that make the determination, but we have worked very closely with the administration within the Department, and find them quite concerned, too.

Mr. HEYWARD. Well, I did not mean that they would not consider your comments.

What I was really asking was whether they had indicated that where you did register an objection to the sale of fishing vessels they would informally agree that they were not going to permit it.

Mr. TOWNSEND. I think for all practical purposes, if NOAA objected, that would be it.

Mr. HEYWARD. I have a couple of questions, Mr. Chairman, for Mr. Wallace in connection with the fisheries.

In your statement you refer to high seas conservation, or words to that effect.

You mention the fact that you were aware of the industry objections to that proposal, but you did not mention the States.

Did the States object to that proposal, or are they in favor of it, or what is their position, if they have one?

Mr. WALLACE. I think it would be difficult to say that there was one position for all of the States. Their own local situation influences their views about the high seas conservation proposal.

There have been some specific suggestions by States for alteration of the bill, which would then, in their view, make the legislation acceptable.

Some States have indicated that they are favorable to the legislation. Other States have said that they rather objected, but if there were certain amendments made which would insure that the State's right for fisheries management as has been traditional would be preserved, that they would then be agreeable to the legislation.

Mr. HEYWARD. Would this type of program serve as a good coordinating mechanism for the various State mechanisms within the territorial limits, which are now divergent in some areas?

Mr. WALLACE. In my opinion it would greatly facilitate this type of thing.

The coordinating mechanisms that now exist between the States are the compact commissions on all three coasts. We are working very closely with them trying to strengthen and improve this mechanism. But, in truth, we cannot quite come to grips with this problem until there is some authority to actually manage the fisheries throughout their range. That is basically what the High Seas Conservation Act would do.

Mr. HEYWARD. The last time we discussed programs with NOAA we had some discussion in connection with vessels of NOAA.

Have they now been put under one management head, so to speak, in NOAA, all of the vessels in NOAA?

Mr. WALLACE. Yes; all of our vessels now are under our fleet operations in the national ocean survey, with the possible exception of some contractual ships that are used from time to time for a very specific limited purposes.

Mr. HEYWARD. Is that an administrative or an operational set up?

In other words, does NMFS have to go to NOS for the use of the ship, or is it simply that they are coordinated?

Mr. WALLACE. Well, they are coordinated; and there are certain ships that are dedicated for specific use, for example, fisheries purposes. In the North Atlantic, the *Albatross* and the *Delaware II* are specifically assigned for fisheries tasks. That does not mean that if they are not fully occupied to do fisheries work that they might not be used for some other purposes. We are trying to use these ships as efficiently as possible because we have great demands for ship time.

Mr. HEYWARD. I assume that is the reason they were put under one head.

Would you furnish the committee with a list of the vessels and the duties, that is those that are dedicated to purely fisheries research, and so forth?

Mr. WALLACE. We will be happy to supply you with this information.

[The information referred to follows:]

DEPARTMENT OF COMMERCE—NATIONAL OCEANIC AND ATMOSPHERIC
ADMINISTRATION ACTIVE NOAA FLEET

Vessels currently used in NOAA programs	Length overall (feet)	Year built	Home port	Program utilization
Oceanographer.....	303	1966	Seattle, Wash.....	Ocean investigations.
Researcher.....	278	1970	Miami, Fla.....	Do.
Mount Mitchell.....	231	1968	Norfolk, Va.....	Hydrographic surveys.
Fairweather.....	231	1967	Seattle, Wash.....	Do.
Rainier.....	231	1968	do.....	Do.
Pribilof.....	223	1942	do.....	Pribilof Islands' operations.
Albatross IV.....	187	1962	Woods Hole, Mass.....	Fisheries investigations.
Davidson.....	175	1967	Seattle, Wash.....	Hydrographic surveys.
McArthur.....	175	1966	do.....	Do.
David Starr Jordan.....	171	1965	San Diego, Calif.....	Fisheries investigations.
Oregon II.....	170	1967	Pascagoula, Miss.....	Do.
Peirce.....	163	1963	Norfolk, Va.....	Hydrographic surveys.
Whiting.....	163	1963	do.....	Do.
Delaware II.....	156	1968	Sandy Hook, N.J.....	Biological investigations.
Ferris.....	133	1968	Norfolk, Va.....	Estuarine and lake investigations.
Oregon.....	100	1946	Kodiak, Alaska.....	Fisheries investigations.
John N. Cobb.....	94	1950	Seattle, Wash.....	Do.
Rude.....	90	1966	Norfolk, Va.....	Hydrographic surveys.
Heck.....	90	1966	do.....	Do.
Murre II.....	86	1943	Juneau, Alaska.....	Fisheries investigations.
George M. Bowers.....	74	1955	Miami, Fla.....	Do.
Shenehon.....	65	1953	Detroit, Mich.....	Great Lakes research.
Virginia Key.....	65	1952	Miami, Fla.....	Ocean investigations.
Rorqual.....	64	1941	Sandy Hook, N.J.....	Fisheries investigations.
Total: 24.				

Mr. WALLACE. I believe Dr. Townsend would like to comment.

Mr. TOWNSEND. I would like to make a comment so that there is no misunderstanding here. We consider all of those vessels to be a NOAA asset.

We go through a formal procedure in which all of the users submit their requirements to a central group. An allocation council. Dave Wallace sits on that council.

The council then looks at all of the requests and makes provisional allocations.

Dr. White is the individual in NOAA who agrees to the proposed utilization of the fleet.

Then the matter of operating the fleet, and keeping it in good maintenance and operating it safely is a responsibility of the National Ocean Survey.

Now, as Dave says, for practical purposes some of the ships are dedicated for just one job. Some of the smaller ships, for example, work only on surveys for nautical charts.

Some of the fishing vessels work only on fishing problems.

On the other hand, there are vessels such as the *Researcher* that will work a number of areas, depending upon the particular need and occasionally work in other disciplines, such as meteorology.

Mr. HEYWARD. Does the NOAA Commissioned Officer Corps man those ships?

Mr. TOWNSEND. No, sir, at the present time the NOAA Officer Corps does not have the bridge on all of our ships.

Over a period of time there will be an evolution toward this, but many of these vessels have the masters and mates that had been with the ships for a number of years. They were employees in many cases of the Bureau of Commercial Fisheries.

We have not felt that we should simply fire those people, and replace them with officers.

Mr. HEYWARD. I believe Mr. Gardner is here. I had one question in connection with the Coastal Zone Management Act.

Based on the experience of that act up to date, are there any changes being considered to the act in connection with, for instances, the limitation of percentages, or in connection with the estuarine sanctuaries, or other features of the act which you have found to be somewhat inflexible?

Mr. GARDNER. Yes, sir, the Office of Coastal Environment has been considering some of the problems—operational problems—that have been raised by the first implementation of the program, and I think that they can fall into three general categories. They may be considered technical in nature, and they are in different stages of consideration.

First of all, as you mentioned, the estuarine sanctuaries provisions of section 312 provide authorization for 50-percent grants to States for the acquisition, development, and operation of estuarine sanctuaries for research purposes, but that authorization extends only for fiscal year 1974.

We anticipate that the States, as they get into the process of developing management programs over the next 3 or 4 years will be addressing some of the proposals that have been made, or the possibility of proposals being made for funding under the estuarine sanctuaries program.

However, inasmuch as the authorization only covers fiscal 1974, we anticipate that there will be some problems in that regard.

We have submitted to the administration, and the administration is presently considering the views of other Federal agencies, an extension of the funding for section 312 through fiscal year 1977, to make it coincident with the terms of sections 305 and 306 of the act.

Mr. HEYWARD. Have you had any actual applications under section 312?

Mr. GARDNER. We have a draft application before us from the State of Oregon.

We understand that as of today there is a final application in the mail for a grant for acquisition of a sanctuary in the South Slough of Coos Bay, Oreg.

Mr. HEYWARD. You do not view section 312 as being in any way limited by an actual final approved program under 305 and 306 now?

Mr. GARDNER. No, sir, we see them as independent, although related.

First of all, in our guidelines, which are now out in draft form, for the implementation of section 312, we have specified that the research that emanates out of a sanctuary that was funded under section 312 should be of immediate use to the State in the development of its management program, and conversely, when the State does so develop its management program it should recognize the existence of its sanctuary, particularly in regard to some of the surrounding activities of land use and water use around the sanctuary.

Mr. HEYWARD. How do you view the interrelationship, or is there any in your mind, between the estuarine sanctuaries and the marine sanctuaries under the Marine Protection, Research and Sanctuaries Act?

Mr. GARDNER. Those two programs of estuarine sanctuaries and marine sanctuaries are being administered jointly in our office.

We think there is a high degree of interrelationship and to the extent possible we will operate them jointly in a unified fashion.

Mr. HEYWARD. You do agree as far as section 312 is concerned that the purpose of that sanctuary is somewhat different than the marine sanctuaries under title III of the MPRS Act?

Mr. GARDNER. Yes; the marine sanctuary program is clearly oriented toward research into the impact of human activities in an estuarine environment.

Mr. HEYWARD. You were going on in connection with your other point on potential changes.

Mr. GARDNER. Yes; as you know, there is a 1-percent minimum and a 10-percent maximum grant size specified for grants under both sections 305, the program development grants and section 306, the program administrative grants.

We think that in the initial years of grants made under section 306 there are going to be substantial problems with the 10-percent limitation.

We anticipate that in fiscal 1975 perhaps as few as three or four States and maybe some additional segments of States will come to us with programs to be approved, thereby making them eligible for section 306 grants.

That brings us to the problem of having fewer than 10 States apply for the available money and having some money basically go unexpended during that time.

We are exploring a number of alternatives at this point and within a few weeks we anticipate we will come forward with a solution to that problem.

The third area deals with the land use legislation that is currently pending before the Congress. The Senate has already passed its land use bill, S. 268, and the House has currently pending before it H.R. 10294, which are basically similar, although there are some technical differences.

We think that it would be useful, in the contingency that the land use proposals become law, that the provisions of the grant ratio and other terms of the program be made coincident with the terms of the enacted land use bill.

There are some differences in the percentage of grants. The initial stages of one of the proposals of the land use bill carries a 90-percent grant ratio and in another section it carries a 75-percent grant ratio, and the program is anticipated to run for 8 years, that is, through 1982.

We think in the event that the bill passes it would be most useful seeing that the programs are basically complementary to operate with the same basic terms.

Mr. HEYWARD. I think that is all I have, Mr. Chairman.

Mr. DOWNING. Mr. Steele.

Mr. STEELE. No questions, Mr. Chairman.

Mr. DOWNING. Mr. Bedell.

Mr. BEDELL. I wonder if you could tell us and I do not know who would take the question, but could you give us a breakdown of the duties of the Officer Corps of NOAA?

Are they dispersed throughout your entire organization or are they just concentrated in the duties related to oceans and research?

Mr. TOWNSEND. No, sir, they are very well distributed.

We have a plan under which they do spend a certain amount of time at sea, a certain amount of time on survey parties and remote area work, and then a certain amount of time at what you might call a desk job.

We use the officers throughout NOAA and in the headquarters offices. In fact, there are a number of our officers out working with other Federal agencies, the State Department, for example.

There are several helping with the seismological and geomagnetic programs in the Department of the Interior.

The NOAA Corps does have a career development plan that is quite conscious in bringing these people along and trying to make the best use of the particular degree that they hold.

As you know, they all have degrees in the physical or biological sciences. We have some meteorologists and some fishery biologists, but there are more engineers than any other single category.

In several cases officers are running some of our major field projects.

Cdr. Larry Swanson is the fellow in charge of our New York program under MESA. We use them just about everywhere in the organization.

Mr. BEDELL. I am wondering, to get to the Bristol Bay question that has been discussed a bit here, the present status of that run is very depleted.

What are the prospects for its regeneration, if you will, or can it be brought back to the levels that would be commercially exploitable?

Mr. WALLACE. I believe our scientists feel it can be restored. However, it is going to take major restraints on the part of all parties involved in the fishery to bring this about. The U.S. Government working with Alaska, is trying to develop appropriate regulations for our own fishermen.

Obviously it is essential that we have the same kind of restraint practiced by the Japanese. It becomes an international matter, no matter how we view it. If we cannot get this kind of agreement, then I would say that this is a very serious situation and we are facing a possible catastrophe.

Mr. POLLOCK. We should add the fact we have annual cycles. There are lighter runs every other year—some are bad and the alternates are worse.

The whole fishery is in a bad state and it does not to be built back up, but I think 1 year you will feel things are going better and improving and the next year it will look pretty good again.

Mr. WALLACE. I think Mr. Pollock has put his finger on a very important point.

You know, sometimes a fishery that may be in serious trouble but will nevertheless, have what is called a dominant year and survival will be suddenly good at sea in the whole system. Thus, even though normally the prospect might be bleak, you will get some recovery.

However, I do not think we can depend upon that as a basic way to go and manage this fishery. We must look at what kind of restraint

we can impose that will bring up the whole level of the fishery throughout its entire cycle.

Mr. POLLOCK. Let me add one other point, not only with reference to the Bristol Bay fishery but concerning all of the salmon fisheries.

The ideal situation in the international solution would be a total prohibition of high seas fishing so that fish could only be taken within the 12-mile contiguous zones, where the salmon begin to segregate to go to their various streams of origin, and when specific stocks are in trouble, the relevant river or stream can be closed to fishing.

Mr. BEDELL. Could it be somewhat similar to the ceiling agreements where they might be taken at the rookeries and distributed to the various companies who participate?

Mr. POLLOCK. We have not gone that route at all in the fisheries arena, as we have in fur seal management.

Mr. BEDELL. I have heard estimates of it taking maybe five to six generations, each of which would be 4 to 5 years long, to bring these populations back up.

Would it be that long, do you think, if we had an agreement today?

Mr. WALLACE. It does take a number of years, perhaps 5 years, to come back. Thus, if you go through the cycle, you are talking about a substantial period of time.

However, there could be substantial improvement even if you are protecting one cycle because 5 years later you would expect some response to this management.

Mr. BEDELL. Is there any prospect of revising the abstention line of 175° W. longitude?

Perhaps, Mr. Pollock, you could answer.

There are areas through which the salmon come and they begin to sort themselves out and follow a particular path in order to return to the particular river from which they came.

Could we, in light of our knowledge of salmon migrations, and the addition of some areas east of that line, that is the present abstention line, negotiate something with the Japanese on that?

Mr. POLLOCK. There are many factors and I think Mr. Wallace would have some thoughts to contribute, but first, 175° W. longitude was a negotiated line, so it is part of an international agreement of long standing. I think it would be very difficult to move the line in a direction detrimental to the Japanese.

On the other hand, over a period of years we have been getting more and more data by tagging the various species of salmon to find out where they go, to find out which ones really belong to the United States, and which ones have other origins; and, of course, you have the interesting new development that Mr. Pritchard was talking about, that the Japanese now for the first time are developing their own salmon fishery from hatchery stocks, and of course, those chums are going out to sea and intermingling with all the other salmon stocks.

Mr. BEDELL. I have no further questions.

Mr. DOWNING. The committee wants to thank you, Mr. Pollock, and your associates for your patience, for your contribution which you have made to these oversight hearings.

Mr. POLLOCK. We have been very pleased to be here. We have had two good long sessions with you, and I think it is very healthy to be able to do this. We are pleased at the interest that you have shown.

Mr. DOWNING. Thank you again.

The subcommittee will stand adjourned subject to the call of the Chair.

[Whereupon, at 11:46 a.m., the subcommittee adjourned subject to the call of the Chair.]